What's in this issue-

One of our editors made a special trip to Washington to unearth the **Navy and merchant marine shipbuilding programs.** He brings you the "low-down" on a "pump-priming" move which will mean large orders for machinery and materials. Page 2.

Special for small-plant operators. If mass production methods can't be applied in your shop, read Lloyd Stearman's account of Stearman-Hammond's **use of special jigs and hand operations** in building the unconventionally designed plane which the Department of Commerce calls the safest yet produced. Page 18.

Are you troubled with fatigue failure in making your product? Chevrolet's method of **sizing and heat-treating disk springs** for its clutches to prevent fatigue failure is told in pictures. Page 4.

An exponent of mass production, Delco Brake uses much special machinery in **making wheel cylinders for hydraulic brakes.** A. L. Ward, factory manager, gives you the facts, with plenty of pictures. Page 13.

What is the best system of **running a tool department.** Tool makers at R.C.A.'s Camden plant are divided into groups of eight, thus removing confusion and facilitating production. Our story brings you the details. Page 6.

Perhaps you don't know that **hand work** still comprises a conprises a considerable proportion of the task of **making electric motors.** Just to prove the point, we show you examples (in pictures) from General Electric's plants. Page 1.

Do you believe that the **"line assembly" method of processing** can be used only by the mass production industries? Well, you're wrong. It is not necessary to have a large output of a single item or of a few items to enjoy partial or complete benefits of that system. This story tells you all about it. Page 9.

Railroad men will be interested in the way in which the Norfolk & Western **machines bronze liners** used on the outside of engine and trailer boxes. See the pictures on Page 11.

In addition to the stories mentioned, you will find in this issue a number of regular departments—The Round Table, New Equipment, the Detroit Letter, Watching Washington, Ideas for Practical Men, Talking Shop and Industry News.

COMING

In the next issue

Equipment builders poured into the market during the past year a volume of new products which fell only a little short of setting a record. There is only one place where you can find all of these products—790 of them—described in print in a single book. That is in our Review and Buyers' Reference Number published January 26.

American Machinist has been giving its readers this service for twenty-five years. The issue this year will contain innovations which make it easier to read and easier to find what you want to know. There will be 13 product groupings as follows: machine tools, accessories, tools and gages, forming, heat treating, welding, cleaning and finishing, parts and materials, electrical equipment, power transmission, materials handling, portable tools, and plant equipment.

For your help we shall include a directory of manfacturers so that you can ascertain in a jiffy the sources of supply for the items that you wish to buy. Our editors started to work on this issue months ago and are hard at it now to complete the job on time. They will give you a number that will be useful throughout the coming year. We suggest that you make a place for it now on your reference shelf.

Tops

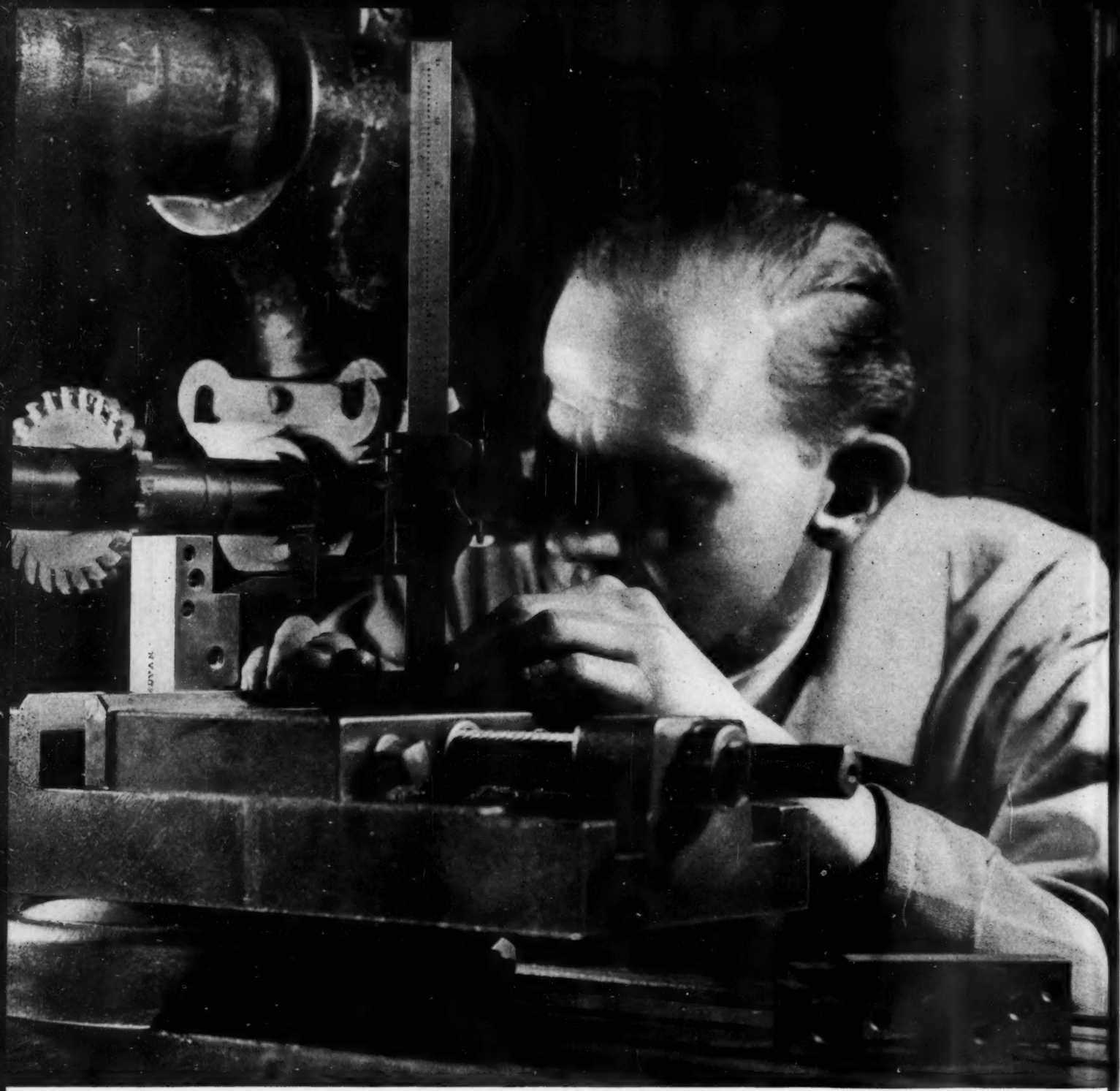
Having made a close check-up of the number of items to be covered in our Review and Buyers' Reference Number, we can't refrain from telling you that we have published in the last 12 months far more descriptions of new metal-working products than any other paper.

In later issues

Some of the countries "Down Under" have gone farther to the Left in their labor policies than the United States. Specifically, New Zealand has had compulsory arbitration of labor disputes for the last two years and has adopted other measures which aren't yet seriously considered here. Edward J. Mehren, former McGraw-Hill editorial director, has just completed a first-hand study of the New Zealand situation, will present you his conclusions in an early issue.

A. L. Ward will conclude his story of mass production technique as employed by the Delco Brake Division of General Motors. He will discuss the manufacture of master cylinders for hydraulic brakes, with special emphasis on the machining operations. The article will be well illustrated.

Perhaps you have been faced with the problem of chip control and disposal in your plant. If so you will welcome the experience of a number of companies as outlined in two articles the first of which will appear February 9. The articles report the current practice in grinding tool tips or attaching chip breakers for the control of chip flow and the breaking of chips into proper lengths for economical and safe handling.



Photograph taken in plant of U. S. Tool Company

Precision-made steels for precision dies

THE "know-how" that comes from long experience is reflected in the complete suitability of the various Bethlehem Tool Steels for their intended tasks. The latest developments for scientific control plus mature human judgment make these steels worthy material for skillful workmanship.

Take Bethlehem Tool Room Oil-Hardening Steel, for example. This fine die steel has remarkable freedom from tendency to warp or shrink in heat treatment. It's prime material for master tools and dies, gauges of many forms, intricate cold-working dies and similar pieces that must be true to a "tenth" after treatment.

Or consider Lehigh Die and Tool Steel. This air-hardening steel has the stamina—the hardness, toughness and abrasion-resisting qualities—to stand up in dies for long-run jobs. Lehigh Die and Tool Steel is particularly adapted to use in blanking, stamping and trimming dies, intricate punches and rotary slitting cutters.

Other Bethlehem Tool Steels are equally outstanding in their particular fields of service.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

AMERICAN MACHINIST

ESTABLISHED 1877

F. H. COLVIN · K. H. CONDIT · BURNHAM FINNEY, Editors

Lift the Fog

IT IS UNFORTUNATE and perhaps tragic that just after American industry has profferred its willingness to sit down with government and labor to help solve the country's present economic dilemma, Mr. Roosevelt's official agents should deliver rabble-rousing speeches against industry, impugning its motives and charging it with responsibility for our sudden loss of prosperity.

Mr. Jackson and Secretary Ickes have made serious charges with the bland disregard of facts of a Father Coughlin. They accuse capital of calling the first general strike against the government and they saddle the blame for high prices on monopolies insidiously created by gargantuan companies.

The idea is fantastic that industry has such a "hate-Roosevelt" complex that it has purposely scuttled profits in an attempt to sink the New Deal. Is it reasonable to believe that the steel industry would let its operations drop from a highly profitable 92 per cent to a highly unprofitable 18 per cent for political reasons? Is it reasonable to believe that the automobile industry, immediately after spending tens of millions of dollars for plant expansion, would cut its activities down to an unprofitable two days a week for political reasons? Industry dissipates its reserves and its resources when it lays off men and stops the machinery in its factories.

Just what does Mr. Jackson mean when he talks about monopolies causing high prices today? Why is he suddenly so excited about monopolies, except to divert the public's attention from the administration's responsibility for the current depression? Has he forgotten that the government of which he is the spokesman has fostered monopolistic tendencies ever since 1933 and has he purposely refrained from mentioning the oft-repeated aim of the New Deal to lift prices to the 1926 high level? Has he conveniently had a lapse of memory regarding the government's course in slaughtering pigs, ploughing under crops, codifying industry, setting retail prices on branded products, regulating the coal industry, advocating a national wages-and-hours bill and encouraging labor to shove up wage scales above 1929 rates, all of which directly or indirectly raised prices?

NOTHING is to be gained by government berating industry and by industry lashing back at government. A spirit of irreconcilable hostility between the two will get us nowhere and may only bog us deeper in the economic mire. Industry, like the government, wants a quick recovery more than anything else. The fastest way to get it is for government to let industry know what its program is to be during 1938. What industry needs is a reasonable degree of certainty upon which it can count in planning current and future operations. An eminent industrialist has said, "Lift the fog and let us see the road we must travel." In his annual message Mr. Roosevelt has given hope that the fog may soon be lifted. It is now the job of Congress and the administration to do the actual lifting, thus taking the first essential step toward a return to prosperity.

Gaging Business

THOUGH IMPROVEMENT in the metal-working industries is hardly perceptible, the outlook is a bit more cheerful. Inquiries for machinery are beginning to appear in some districts. New machine tool orders, however, are almost nonexistent and don't promise much this month. Were it not for foreign bookings, machinery builders would be operating far below current levels. Customers are chary about buying small tools and supplies. Steel has rebounded from its recent low with the ingot rate now above 26 per cent. After the most precipitate production drop in history, automobile makers expect a slight upturn the latter part of January.

Agricultural implement companies, currently in a seasonal slump, are building up inventories of finished goods for the first time in years and with farmers generally prosperous no serious shrinkage in sales is anticipated in the spring. Electric household appliance manufacturers are running four and five days a week, whereas many other industries are down to two days. Many metal-working companies find consolation in the fact that talk of further recession has almost disappeared. Business Week's index stands at 64.7 contrasted with 64.1 two weeks ago and 82.0 a year ago.

CHICAGO—With employment and payrolls at about where they were a year ago, local industries are not faring so badly. International Harvester and Western Electric started '38 with more workers than at the '29 peak. Woodworking machinery makers have just closed one of their best years since 1929, though sales were far below the level then. Stuck in a financial mire and with traffic off, railroads will yield little steel or equipment business this quarter.

NEW ENGLAND—Many factories have laid off men and are operating only 24 or 32 hours a week. Larger industries, such as textiles, foresee no improvement the next month. Typical of reports is that of one company which is curtailing purchases "until times get more settled in Washington."

CINCINNATI—Machine tool builders say that domestic orders are very scarce. Were it not for foreign business, local machinery plants would be pretty flat. General Motors Divisions at Dayton, with considerable diversification of products, are running four and five days a week.

PITTSBURGH—Steel operations are slowly on the mend, but steel mills aren't counting on much of a lift in output this month. Heavy schedules of companies making rolling mill equipment afford a bright spot.

CLEVELAND—There has been a slight pickup in orders and inquiries for equipment and local industrialists feel better than they did a month ago. Auto parts makers and steel mills are suffering from the dearth of automotive releases.

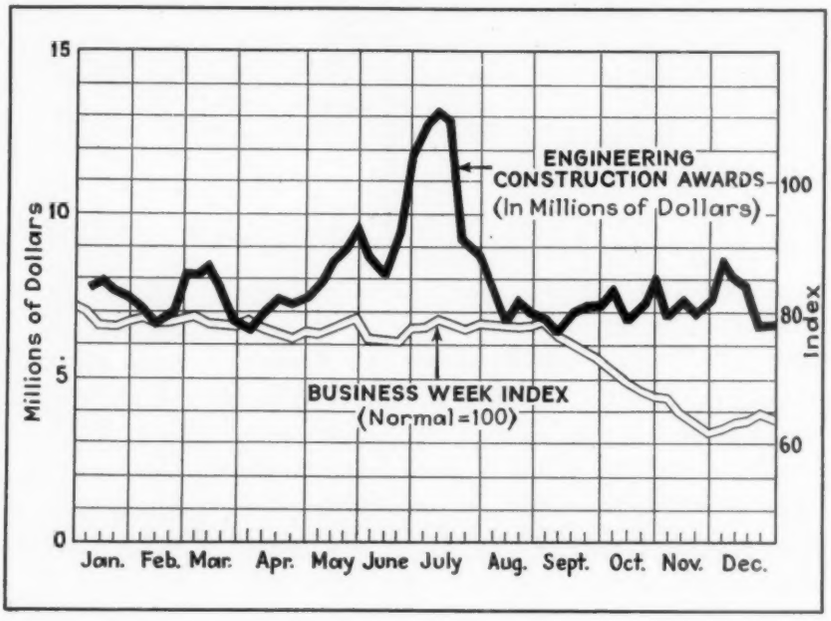
SAN FRANCISCO—Western shipyards were expecting to participate in the huge shipbuilding program sponsored by the Federal government. Aside from this development the immediate outlook is drab. Backlogs of metal-working plants have dwindled badly. Despite the autumn slump, volume for the year 1937 was bigger than for 1936. A large loss in building and construction work has been the most depressing factor.

NEW YORK—A few machinery orders are trickling in and more inquiries have appeared, but improvement isn't likely much before April 1. Interest has been aroused in the government's shipbuilding program.

DETROIT—Ford is in the market for large numbers of presses and machine tools some of which already have been bought. Die shops are starting to get busy and improvement within 30 days is believed certain.

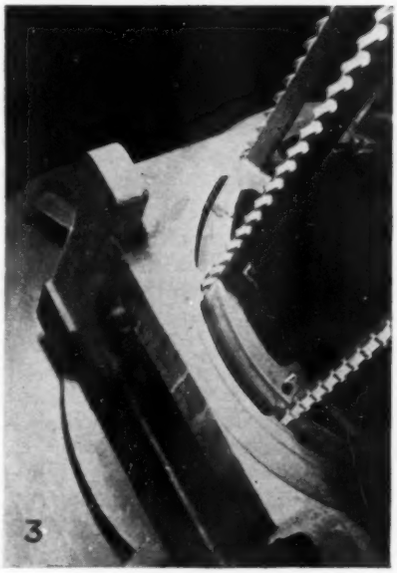
CONSTRUCTION VS. GENERAL BUSINESS

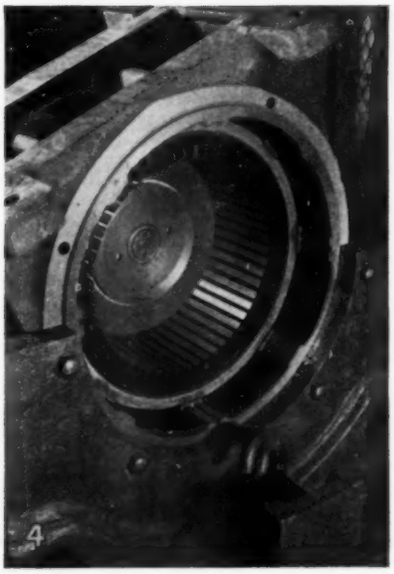
Belief is general that the lag of building and construction work has been an iron collar around recovery's neck. Here is an accurate measure of business compared with construction awards for 1937



MOTOR PARTS IN MOTION

Electric motors comprise industry's chief motive power. They contribute largely to their own processing by furnishing the driving force for the machine tools on which they are built; but hand work by highly skilled artisans still forms a surprisingly large proportion of the operations that go into their making. Pictures are from General Electric Company's plant at Schenectady.





1. The stator is stationary while the boring mill operator gages his work; he is rabbetting the frame face

2. There's no substitute for skill in a scraping operation. This man is painstakingly finishing the bearing for a large steel-mill motor; a small mistake may cause motor failure and lead to a large loss

3. An automatic broaching machine simultaneously slots the stator frame groves which key in place laminations on large induction motors

4. Laminations assembled, the stator bore is finish ground to true the air gap surface

Ships and Jobs

Parallel Navy and merchant marine shipbuilding programs promise orders and jobs for the metal-working industry

K. H. CONDIT
Editor, American Machinist

PRESIDENT ROOSEVELT'S letter to Chairman Taylor of the House Appropriations Committee warning him that there may be a request later for additional funds for warships implies work for the heavy industries at a time when work is needed. Conjecture as to the type of craft the President has in mind must be relied upon for estimates of the possibilities of the program until Mr. Roosevelt sends his message regarding them.

Already provided for in the 1939 Navy budget of $564,000,000 are two battleships, two light cruisers, eight destroyers and six submarines. Battle cruisers and aircraft carriers built or building are up to the old treaty quota which has served as a guide for Navy planning.

Sentiment in Congress indicates that Mr. Roosevelt's experience as Assistant Secretary of the Navy and his access to expert advice will be accepted, and that his recommendations will go through. Whether these recommendations are limited to a relatively moderate addition to the Navy budget or expand into a major armament or "defense" program remains to be seen. At the moment there is reason to believe that the larger program, involving perhaps a billion dollars, may develop within six months.

Effective Pump Priming

From the political point of view such a program, large or small, would be as effective a pump priming move as the type of pump priming that was used early in the Roosevelt administration. It would have the advantage that popular support for it could be rather easily stimulated through judicious propaganda, whereas the other type of pump priming is distinctly in disfavor. Furthermore, it could be accomplished without any additional unbalancing of the budget, by switching relief funds to a defense program—but it probably will not be.

At the press conference where the President announced that he was sending the letter to Chairman Taylor he was asked whether he contemplated increases in personnel, in aviation, in army allotments. He replied in the negative. There is in Congress, however, considerable support for added air equipment, and some opposition to the spending of huge sums for modern battleships.

According to a recent Navy release the Vinson-Trammell Act provides for nine additional battleships, 17,000 tons of light cruisers, 64,000 tons of light cruisers, 64,000 tons of destroyers and 19,000 tons of submarines. These can be started the moment Congress appropriates the money for them. Plans are complete for several types of ships and contracts could be let within two months, keels laid within six months.

Under the terms of the London Treaty of 1936, three battleships could have been started in 1937. Two actually were begun, the North Carolina and the Washington. Four can be started in 1939, one each in 1940, 1941, 1942 and 1943. No further heavy cruisers or aircraft carriers are authorized under the Vinson-Trammell Act.

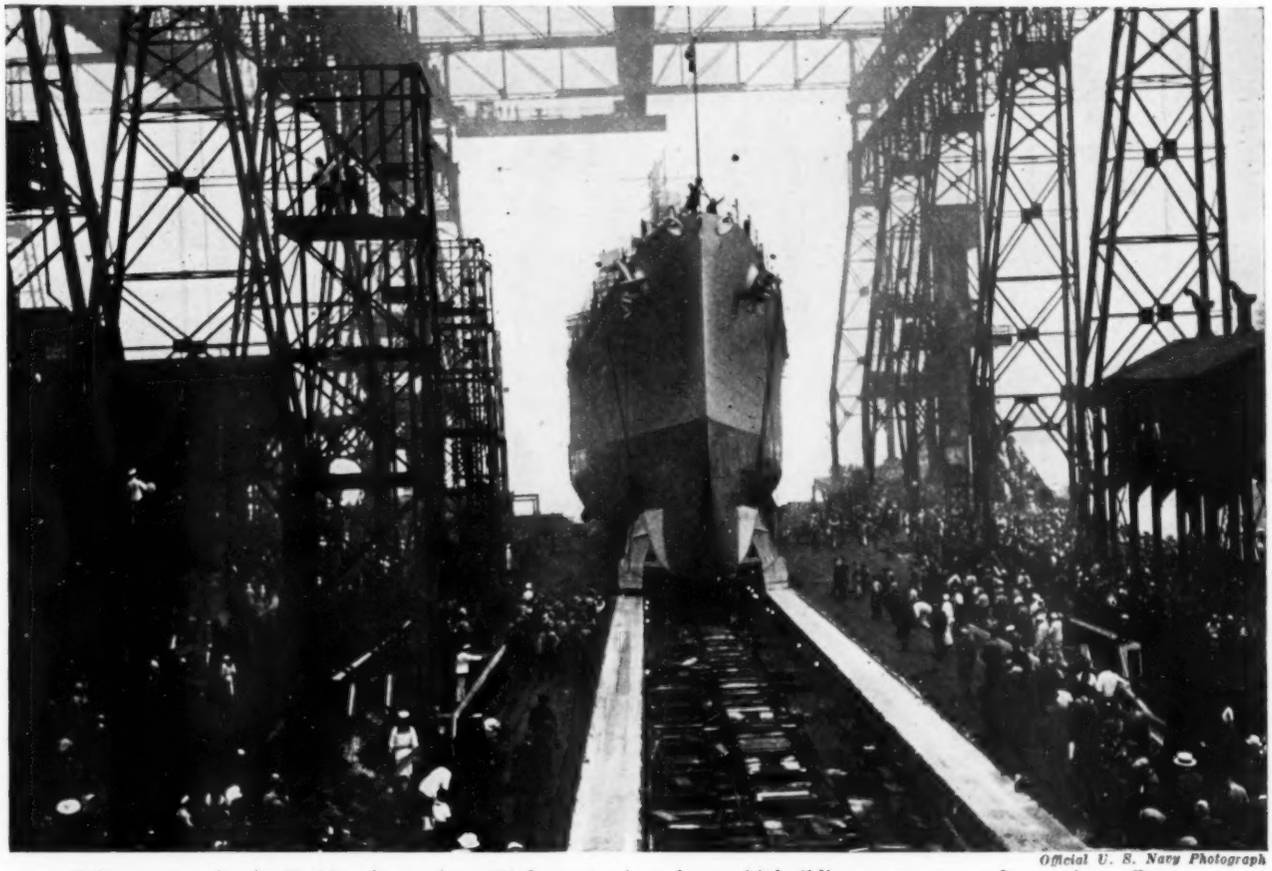
With these facts at hand it is possible to interpret the President's letter as foreshadowing a request for appriations to cover the battleship authorized but not started in 1937, and some or all of the unbuilt tonnage in the lighter classes. On the other hand, if it is assumed that the President will ask for additional authorizations, then there may be one or more additional aircraft carriers and heavy cruisers as well.

Another development which is in the rumor stage as this is written, but which may be a fact by the time it is printed, is a proposal to include in the legislation to be asked for a revision of the Navy Department structure. According to this proposal a Navy general staff would be set up, the General Board of the Navy would get a stronger standing in law, and the shore establishments would be enlarged. How great the need for improving the equipment in the shore establishments is has been told in detail articles by Lieutenant-Commander R. J. Walker, Lieutenant W. K. Mendenhall and others (*AM* Vol. 78, page 861, Vol. 79, page 353, Vol. 80, page 37). It is sufficient to repeat here that need for equipment modernization is acute.

Obsolete Merchant Ships

If U. S. fighting ships are inadequate in number and not all as modern as they should be, they are superb compared to the merchant marine, second line of defense of the Navy. According to the "Economic Survey of the American Merchant Marine" published Nov. 10, 1937 by the United States Maritime Commission, 1305 vessels aggregating 8,407,000 tons are more than 20 years old. Here is a quotation from the report: "One of the chief difficulties of the American merchant marine has been our lack of a stable policy. That lack forced us during the World War into the mightiest shipbuilding program in history. That program in turn has brought us face to face with the problem of replacing a majority of our vessels, both foreign-going and domestic, within the short space of a few years. The American merchant marine, unfortunately, was built as a unit; the American merchant marine, unfortunately, is about to obsolesce the same way."

The Maritime Commission figures that it would cost $2,500,000,000 to build the 261 ships a year necessary to replace obsolescent units, and calls this an obviously impracticable pro-



Official U. S. Navy Photograph

Shipways may be the limiting factor that will determine how fast a shipbuilding program can be put into effect.

gram. Subsidized lines have been studied carefully and it is concluded that the most that might be expected of them is to build 65 ships in the next five years. So many contingencies are involved in this program that it may very well dwindle to a small fraction of the estimated total. If it does the government will have to step in and build ships.

Assuming that the lines can go ahead with the 65-ship program, the total amount involved is $137,000,000. Of this sum the government through the Maritime Commission would contribute at least $50,000,000 or $10,000,000 a year. The Commission has $85,000,000, and has available an additional $115,000,000 authorized by Congress, or $200,000,000 altogether.

In November the Commission had a building program consisting of one large passenger ship, 10 or 12 tankers, and 8 or 10 cargo vessels. It is understood that this program has been enlarged since, and that work on it will start at once.

From the national defense angle certain types of ships are required, most of them capable of higher speeds than are considered economical in commercial traffic. The Navy, for instance, needs 20 tankers fast enough to accompany the fleet, and some 300 of various sizes and speeds for other work. The Maritime Commission has proposed as a policy that if tankers of the first type are built with private capital the additional cost of equipping for the higher Navy speed should be borne by the government. Twelve of these fast tankers were announced last week. They will be built by the Standard Oil Company of New Jersey at four different yards. The government's share of the $37,500,000 expense is $10,500,000 and is for tripling the installed horsepower.

What About Shipways?

A question that immediately arises is whether there are shipyard facilities for parallel Navy and merchant marine building programs. The Maritime Commission finds that 15 ways in six yards—ten ways on the east coast and five ways on the west coast—are now available. Of the 27 additional ways that will become available within six months, 18 are on the east coast and nine on the west coast. If the Navy goes into a battleship program there are four private yards and six Navy yards that can accommodate major craft. Obviously, too large a combined program cannot be undertaken at once, there are not enough shipways.

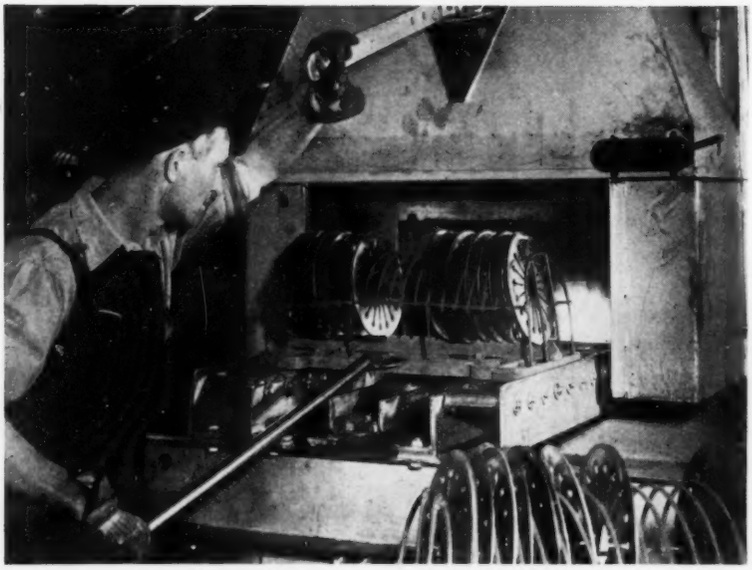
How much of the load of these two potential building programs is going to fall upon the metal-working industry? There are several ways of estimating the size of it, but the simplest seems to be to accept the expert opinion that about one-third of the cost of tanker or cargo ship is represented by the machinery. In a passenger ship the proportion may rise to 40 per cent. That proportion represents an appreciable amount of business for the industry and will provide many thousands of hours of employment for men of the industry.

It is further estimated that 40 per cent of the total cost of a ship is for labor in the shipyard, and 50 per cent is for materials. Of the $40,000,000 that would be spent for materials and equipment in a $75,000,000 program, $30,000,000 would be spent by the suppliers of these two items for wages.

The actual program for both kinds of shipping will probably be several times $75,000,000. The proportion of it going to wages in the shipyards and in the metal-working industry is both a major contribution to national defense, and a "pump-priming" move of real significance.

CLUTCH SPRINGS FOR CHEVROLET

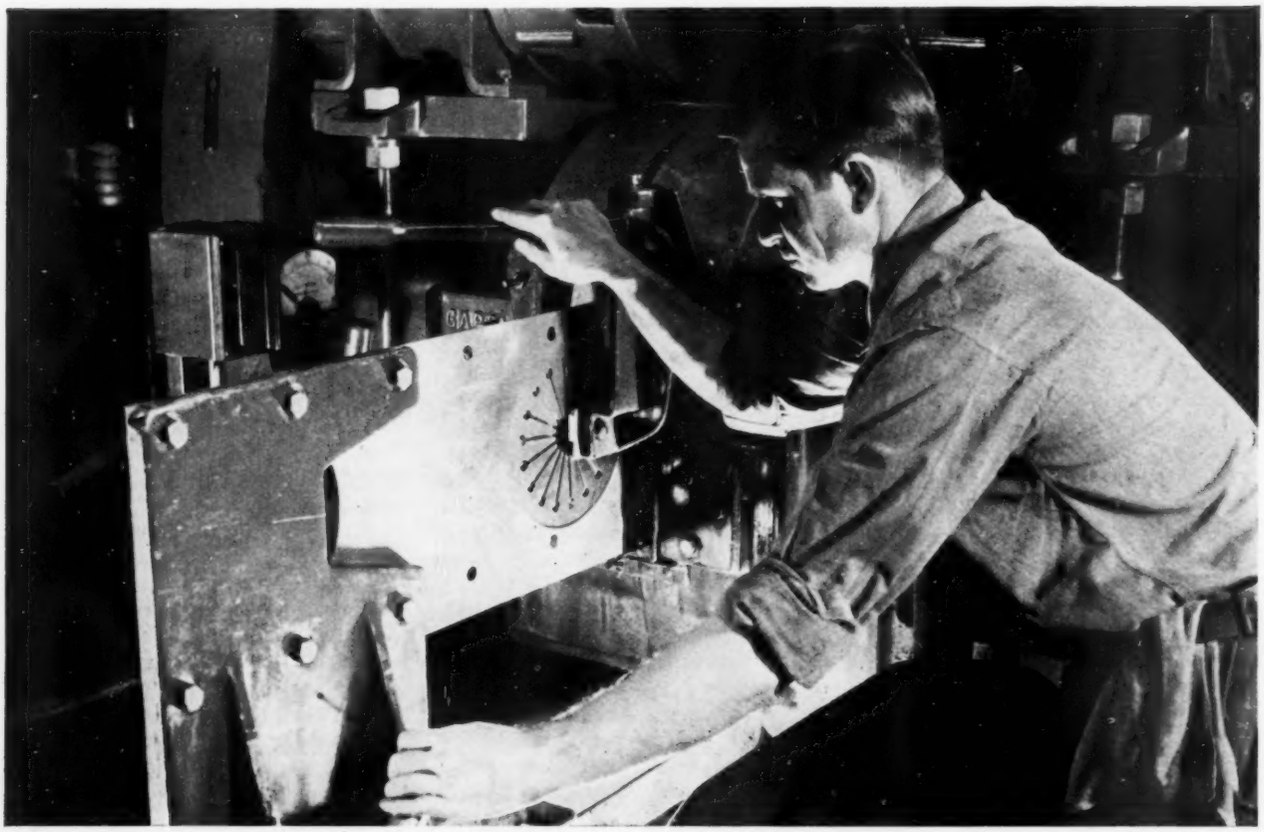
For its 1938 model, Chevrolet has adopted a disk spring for engaging and disengaging the clutch. It is important to correct operation that spring pressure be evenly distributed over the entire plate and that sizing and heat-treating operations be carefully carried out to prevent fatigue failure under service conditions.

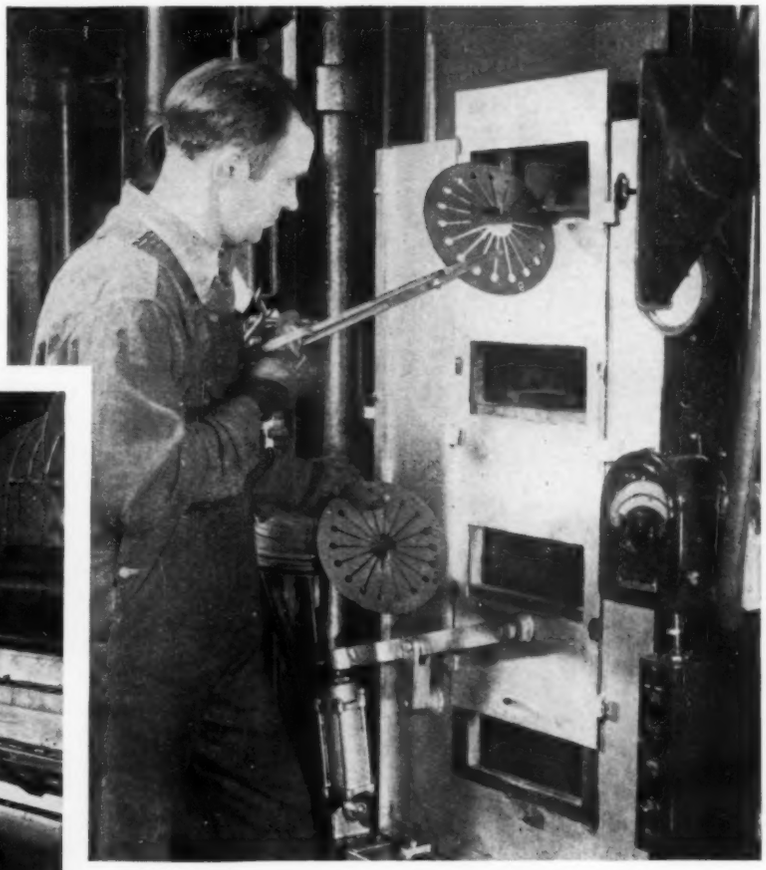


Following blanking and piercing operations, the disk spring is heat-treated to remove strain in a rotary Holcroft furnace. After grinding a second heat-treating operation is performed in another Holcroft furnace (illustrated) which uses a burning gas curtain to keep the combustion chamber free from an oxydizing atmosphere

The sharp edges of the slot are beveled in a press, and the disks are checked for uniformity, using a limit gage and dial indicator

Disks are sized for thickness in a double-wheeled Gardner grinder while held in the blade of a sliding fixture





Final heat-treatment and forming are combined in one operation; disks are heated to approximately 900 deg. and are dished simultaneously under a 250 lb. hydraulic pressure

Shot blasting is preferred to polishing as a finishing operation because it has been found to improve the fatigue life materially

The spring is magnetized in a powerful magnetic field and then inspected for minute flaws by means of the Magnaflux process

The second stage of the Magnaflux process is to dip the springs into a carbon-tetrachloride solution which has fine iron particles in suspension. After the springs are washed, iron dust adheres to the edges of the crack making it look like a fine pencil mark

Toolmaking by Squads

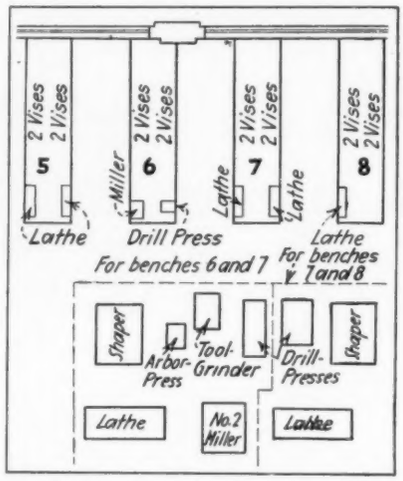
Each group of eight men is supplied with its own essential equipment in RCA's novel toolroom set-up

C. W. GISNER
Superintendent, Tool Shops
Camden Plant, RCA Manufacturing Company, Inc.

FOR A good number of reasons the the RCA die and mold toolrooms are now reorganized on a unit basis. Each unit consists of two benches providing working space for eight men, suitable bench equipment, a sub-toolcrib and at least four different machine tools for the use of that unit only. One man of the group passes out small tools and acts as a squad leader. He reports to the sub-foreman of which there are three to a floor.

The unit system removes the confusion that may creep into operation of a toolroom along conventional lines, because:

1. Each group has right at hand practically all of the mechanical equipment and tools that it needs.



This detail from the floor plan below shows each squad's working area

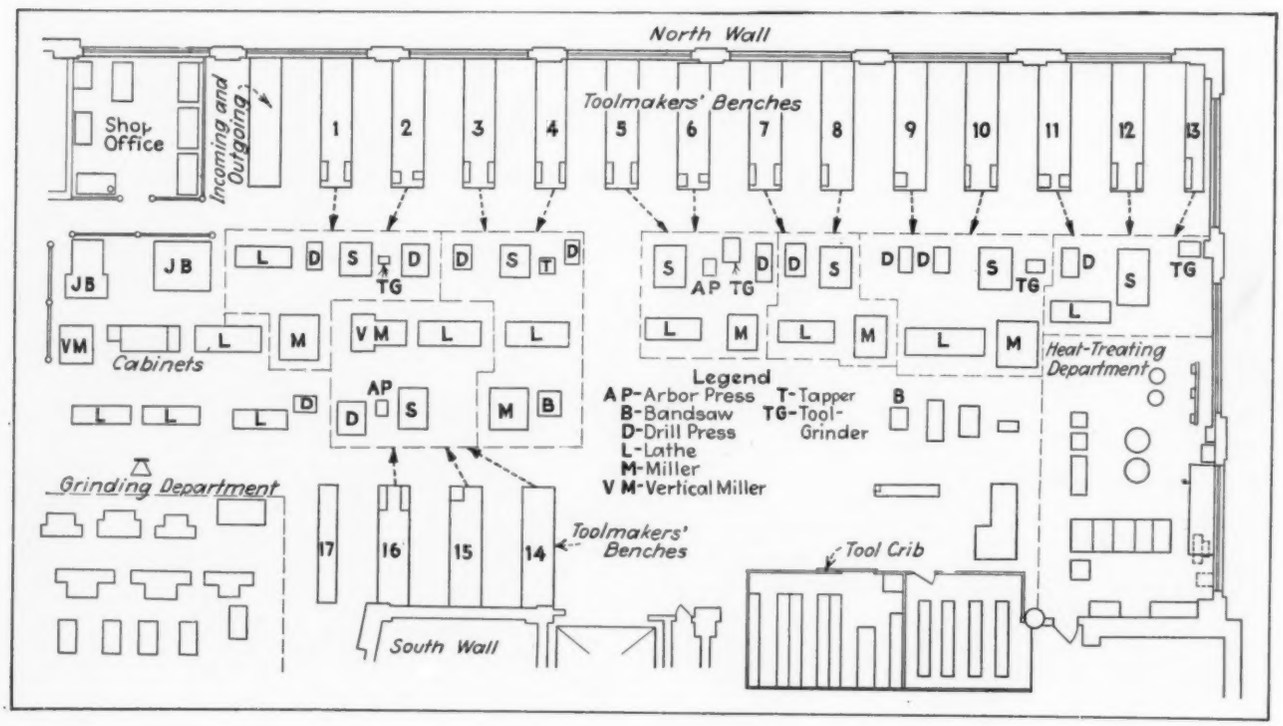
2. Any group can specialize on certain kinds of work and be given the necessary special equipment.

3. The unit system achieves unusual neatness in the department.

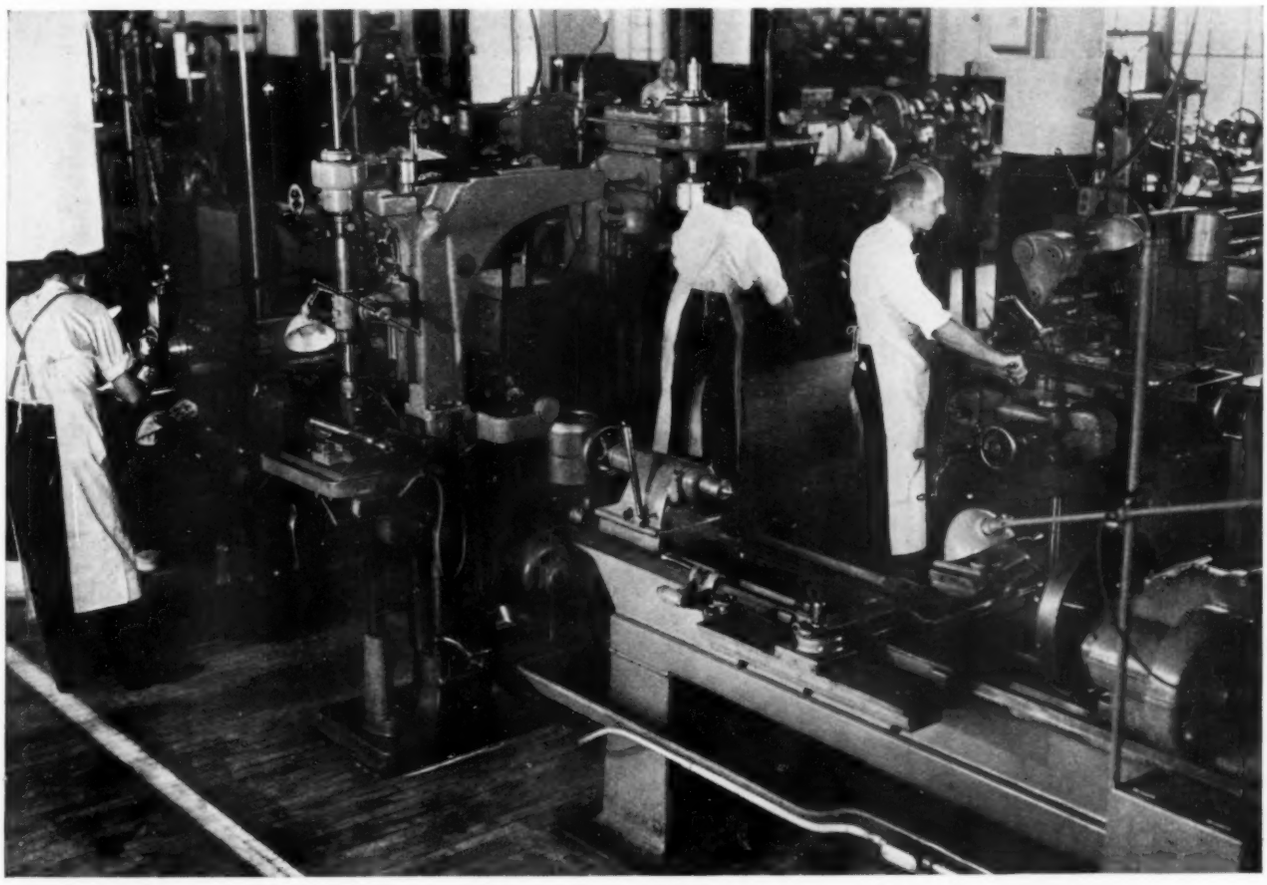
4. Time is saved—the men are constantly working in a restricted area, they are not delayed at toolcrib windows and supervision is easier.

As the layout shows, thirteen benches are arranged at right angles to the north wall, and four benches at right angles to south wall. At the west end of the floor is a segregated grinding department, and at the east end there is a heat-treating department.

Space for two vises is provided on each side of each bench. Thus, four men work at one bench, two facing



Orderliness of the benches and complete absence of material or junk on the floor is the day-by-day state of this toolroom



Toolmakers are not kept waiting for machine tools, or forced to search for an idle machine some distance away

***Left*—The squad leader for each group is responsible for that group's sub-toolcrib. *Right*—The surprising number of small tools, attachments and materials kept in a small cabinet saves many steps to the main toolcrib**

two. Bench No. 1 has two bench lathes near the aisle end, whereas Bench No. 2 has a bench lathe and a drill press. Other benches have millers, or special equipment for certain classes of work. For example, Bench No. 13 is used by men doing a large amount of special coining and swaging die work.

Two small platforms on each bench provide room for the machinists' tool kits. These platforms straddle the longitudinal dividing board, where one is used, so that the kits detract as little as possible from the working area. Moreover, the kits are arranged in rows when looking down the department. This symmetrical arrangement is conducive to orderliness but is not solely responsible for it. The accompanying photographs show that there are no objects on the floor; all work must be kept on the bench surface, and no junk can accumulate below. Thus, the sweepers have a clear road to work in during the night.

Some shops cover the benches with linoleum, some with stainless steel, while others make no effort to improve on a plain wood bench surface. At RCA the toolroom benches are covered with tempered Masonite, a pressed-wood product that comes in sheets. It is hard and smooth, permitting heavy pieces to be slid around with ease, does not mar readily and thereby prevents splinters in the toolmakers' fingers.

Other adjuncts to the benches are individual lamps, compressed air lines, and small aluminum chip pans placed under the bench lathes. These pans have two legs welded on the outer edge so that they can be slid under the machine until the legs abut against the edge of the bench. Thus, they are always in place.

One of the greatest time savers in the reorganized toolroom is the use of a sub-toolcrib with each unit. This crib is under the control of the squad boss and offers a supply of all of the small tools, attachments, screws and drill rod that his group is likely to want in the course of a day's work. It is his duty to see that the proper tools are always on hand, and he knows where the tools are. No longer is it necessary for a toolmaker to run to the main toolcrib, and no longer is there a waiting line at the toolcrib window. In fact, only one attendant is now required, whereas two were needed under the old system.

A typical sub-toolcrib may have: collets and faceplates in the most wanted sizes, chucks, machine vises, steadyrests, all small lathe tools, T-bolts, drill sets from Nos. 1-60, and $\frac{1}{64}$-$\frac{1}{2}$ in., tap drill sets, center drills, taps, tap wrenches, stripper screws and dowels, short pieces of drill rod in popular sizes, sets of reamers for dowel pins. The screws and similar material are kept in a specified number of pieces for each size and the squad leader can tell immediately how many have been used during a day's work. Thus, he is able to check against the quantity requisitioned from the main toolcrib.

Across the aisle from the benches are the groups of machines reserved for the various units. So far as possible each unit has the following machines at its disposal: a No. 2 sensitive drill, a No. 2 power miller, a 14-in. engine lathe, a 16-in. shaper, and a double-end tool grinder. Portable equipment, such as a die filer on a rolling stand, can be wheeled into position by anyone having use for it. Screw presses for trying dies are located in the center of the shop. Thus, the means are at hand for any man of each group to carry out his work expeditiously without getting in the way of other men, walking around the shop, or waiting for someone else to release a machine.

Practically the only operations a toolmaker does not do are jig boring, grinding and hardening. For these, it is considered best to have specialists. Moreover, segregation of grinding practically confines to one location any dust and grit that is not removed by the exhaust system.

An Eye for Metals

One solution to man's desire for an eye to see into metals is the X-ray, but this solution has several commercial limitations. The "eye" developed by Professor Kouwenhoven of the Johns Hopkins University, in collaboration with A. E. Vivell of Princeton University, is based on the principles of magnetism and may be termed the "magnetic eye."

In this method, the welded seam is magnetized by a powerful alternating magnetomotive force. For welds less than ¼ in. thick, 60-cycle current may be used to insure penetration of the magnetic flux. Two search coils connected in opposition are placed on the seam so that any stray field which may be present cuts their windings. The shape of the wave of electromotive force induced in the coils is observed by an oscillograph.

From a paper presented at the eighteenth annual meeting of the American Welding Society.

Assembly Analysis

A study of methods will usually eliminate extraneous operations and suggest more effective use of the assembler's efforts

T. G. LAUFER,
R. H. Rositzke & Associates

MANUFACTURERS frequently find their greatest problems in assembly operations. It is the point at which all parts and sub-assemblies must be brought together at a given time to meet delivery schedules. Improper production planning or many last-minute changes of specifications will seriously offset performance.

Methods analysis that precede definite steps for correction of existing difficulties will often disclose many sources for improvement. One such analysis revealed that only 33 per cent of the total time was actually needed for assembly work and that over 39 per cent of the time of experienced operators was spent on filing parts. It is obvious that the effort required at a high rate of pay in assembly can often be minimized through the adoption of proper jigs, fixtures, tools, dies and inspection control.

The basic principle involved is the reduction of errors to a minimum at the source. The ideal assembly condition is one where assemblers spend 90 per cent of their time in simply bringing together the component parts and sub-assemblies. A methods analysis of the effect of improper conditions upon the assembly activities will bring to light several desirable objectives.

Evaluation of the effect upon assembly costs and schedules will result in proper appropriations for improvements. Reduction of elements foreign to assembly requirements will reduce apprentice learning time and improve their progress. The shortage of skilled workers can be lessened by this means. In certain types of assembly such a program will pave the way for line assembly.

A great many manufacturers in the metal-working and machine building industries throw up their hands when they hear the words "line assembly." It is almost a religion to believe that this method of processing can be employed only by the mass-production industries. Contrary to common belief, it is not necessary to have large production of a single item or a few items in order to enjoy the partial or even complete benefits of this system. But first, it is necessary to give consideration to the following factors:

1. How many items of different specifications are normally produced?
2. Do "specials" simply have superficial or minor changes from basic specifications?
3. If present equipment is fixed and cumbersome, how flexible and light can it be made and still be effective?
4. For all items of a given type what are the differences in total assembly time?
5. Differences in the sequence of operations for various specifications should be noted. Are such differences necessary? If so, how flexible can the necessary equipment be made?
6. How clearly are operations established? Is it possible to split up excessively long operating cycles? Is it practicable to combine operations having too short a time cycle?

Conditions which may seem impossible to modify will resolve themselves upon application of an open-minded analysis. For example, in the analysis of the major item in one line of products it was found that several weeks were required for "in process" inventory and that intermediate return of items into "stores" was done to accommodate an accounting control. The product was one that re-

Subdivision of assembly operations prevents bottlenecks, places responsibility for poor work directly on the operator concerned

quired exact inspection and observation of close tolerances and was moreover, subject to uneven and difficult sales demands.

Several worthwhile objectives were attained by making the analysis presented in the table. This study achieved the following:

1. A decrease of 14 per cent in assembly time without increase in energy required from the operators.

2. Full inspection and correction closer to the final operation. (It was a type of assembly where correction here improved the quality. There are cases where earlier correction is essential.)

3. Skill requirements on the first operation were reduced through separating the work into three operations. Poor quality could be traced directly to the operator who is responsible.

4. Breaking-up the first operation made the item eligible for a modified form of line assembly. The bottle neck operations, when reduced to simpler activities, lent themselves to line synchronization.

Methods Analysis Preceding Operation-Sequence Development for Line Assembly

		Time Allowance, Min.			
	Operations Before	*Before*	*After*		*Operations After*
No.	*Description*			*No.*	*Description*
1	Clean parts	.....	14.00	1	Straighten
	Assemble job	.....	36.00	2	Assemble, drill
	Attach parts	108.00	.....		Dowel & 1st Adj.
	Fit side parts	.....	40.00	3	Straighten,
	Attach sub-assembly	.....	.....		Adjust and inspect
2	Broach bar	18.00	18.00	4	Broach bar
3	Put broach	10.00	29.00	5	Assemble att.
4	Pull broach	10.00	38.00	6	Assemble springs to body
5	Assemble attachment	60.00	12.00	7	Apply spring to device
6	Assemble springs to body	33.00	12.00	8	File ends of device
7	File ends of device	17.00	15.00	9	Assemble
8	Assemble	15.00	30.00	10	Inspect and correct
9	Inspect and correct	30.00	17.00	11	Place steel mats
10	Place steel mats	17.00	17.00	12	Pull steel mats
11	Pull mats	12.00	11.00	13	Run mats
12	Run mats	12.00	.....		
		337.00	289.00		

5. The work in process time was reduced to less than one week.

Of course this example illustrates an analysis preceding the actual development of operation sequences for line assembly. The next step is to develop assembly layouts which will accommodate flexibly a number of different specifications covering a given line of product. Each item within the line must be analyzed in detail then several steps are essential:

1. Classify all items as to over-all length of time required for completion (shortest, medium, and longest time cycles).

2. Analyze equipment necessary in finishing or assembly work as to the nature, whether fixed or inflexible, semi-flexible, light and movable.

3. Determine changes in position required of such assembly equipment.

4. Determine how assembly equipment may be made flexible through redesign.

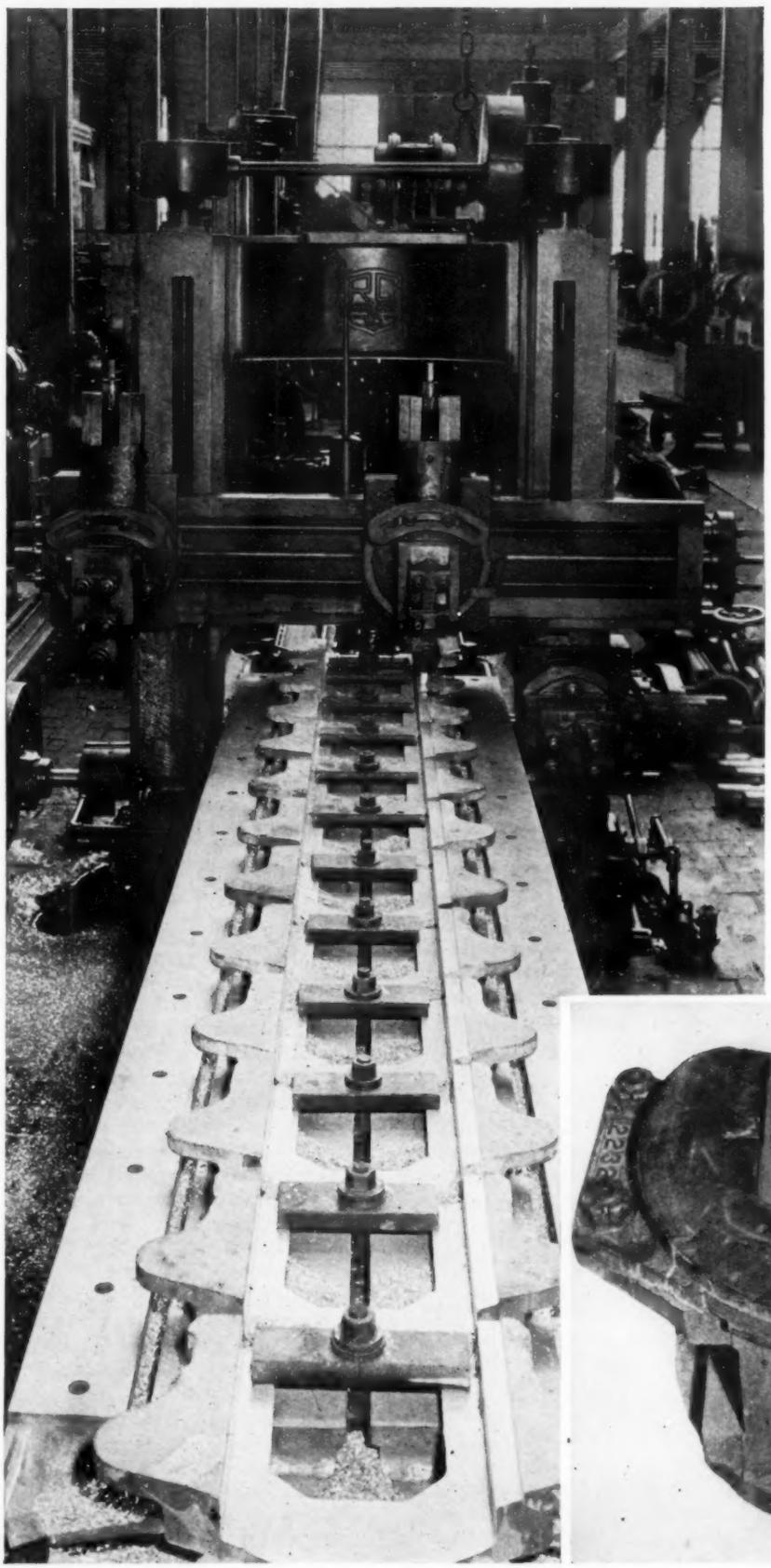
5. Balance current delivery requirements of the various items against annual sales requirements. This will be governed to some extent by the irreducible number of people necessary on a given assembly.

6. Then determine the number of different lines desirable to: (a) Give necessary current delivery and schedule flexibility; (b) Justify investment in equipment as compared with the benefits derived; (c) Avoid the necessity for building excessive stocks or working force.

There are many types of assembly which will not lend themselves to line assembly even though in a highly modified form. There are others, however, where it is believed impractical, but nevertheless can be applied to good advantage. One thing is certain. There are few assembly activities that cannot be benefited by and improved through a proper methods analysis.

Operators should spend 90 per cent of their time in bringing together components and sub-assemblies, not in overcoming poor work

SECOND OPERATION ON BRONZE LINERS



A SOMEWHAT UNUSUAL planing job is shown in Fig. 1. Here the second operation is being performed on twelve phosphor bronze engine and trailer box liners at one setting. In the first operation the liners are held by means of clamps on the outer surfaces while the inner surfaces are being machined. Then, before the outside clamps are removed, the inner clamps are put in place. After removing the outer clamps, the outer surfaces are finished to provide a good seat on the box to which it is bolted.

In addition to the center clamp, there are four stop screws with pointed pins, one at each corner of the string of liners. The two at the rear can be seen beneath the crossrail of the planer.

Fig. 2 shows liner after it has been machined and bolted in place on the truck box.

The practice shown here is that used at Roanoke Shops of the Norfolk and Western Railway.

"They'd None of 'Em Be Missed"

Additional answers to President Roosevelt's challenge to critics to say what government agencies or departments might be eliminated in the interest of economy

Decrease expense of government by 25 per cent—

My reply would be something like this:

"Mr. President, I believe that you are better qualified than anyone in business to decide just what functions or agencies of government should be done away with at the present time in order to economize.

"In 1932 you promised the country you would decrease the then existing expense of government by 25 per cent. That statement was made after long association in Washington and with an intimate knowledge of the details of government. The past four years have increased your opportunities for observation along these lines. As a starter I would suggest that you put into effect those economies which you had in mind in 1932 when you promised 25 per cent reduction in the expenses of our Federal Government.

"I believe I am better able to decide where economies of operation of the company of which I am executive head can be made when retrenchment is necessary, than one who is only a stockholder in that company, and likewise, I am sure that you can best decide how and where the cost of government can be cut down now."

ROBERT M. GAYLORD
President,
Ingersoll Milling Machine Co.

This country cannot exist half New Deal and half free—

The question stated by President Roosevelt isn't a matter of cutting out or paring down a few government spending agencies, commissions, or bureaus. It is far more fundamental than that. In its final analysis, the question becomes "do we purpose to support a government in this country that undertakes to exercise the functions of private initiative, capital and enterprise?"

In the crisis of 1932, and as a temporary relief measure, it may have been suitable for the government to have assumed the power and authority to offset the ravages of the depression. Even this is debatable when it is seen how other countries have so far outdistanced us in industrial recovery; but a permanent encroachment of governmental functions heretofore considered as belonging to private enterprise is the negation of the democracy under which we have prospered and become great.

As Lincoln said in another great crisis—"This country cannot exist half slave and half free," so today are we confronted with another crisis and again it can be said that this country cannot exist half New Deal and half free. We are at a crossroads where the choice seems clear—either we must abandon the New Deal and all its cost—waste—moral breakdown—and false economies—or we must project the New Deal into our entire economy, and we ourselves become the subject vassals of a dictator and government bureaucracy.

JOHN R. MUNN
Vice President
American Gas Accumulator Co.

See that functions of government are at least not permitted to increase—

In a constitutional democracy, once a new department of government is established, it is almost impossible for political reasons to get rid of it. The damage has already been done and what is needed now is to see that the functions of government are at least not permitted to increase.

A good deal could be done if we should—

1. Cease giving blank checks to the President.
2. Limit farm subsidies to the tariff revenues received and get rid of them as fast as possible.
3. Turn relief back to the states on a grants-in-aid basis.
4. Abandon the original power program; that is, the little TVA's.
5. Stop baiting the states with federal grants, and contract the present program in this field as much as possible.
6. Curtail the public building program and confine it strictly to projects that have economic value.
7. Stop subsidizing uneconomic programs.

A New England Manufacturer

May sound like a jest, but I am telling it in utmost seriousness—

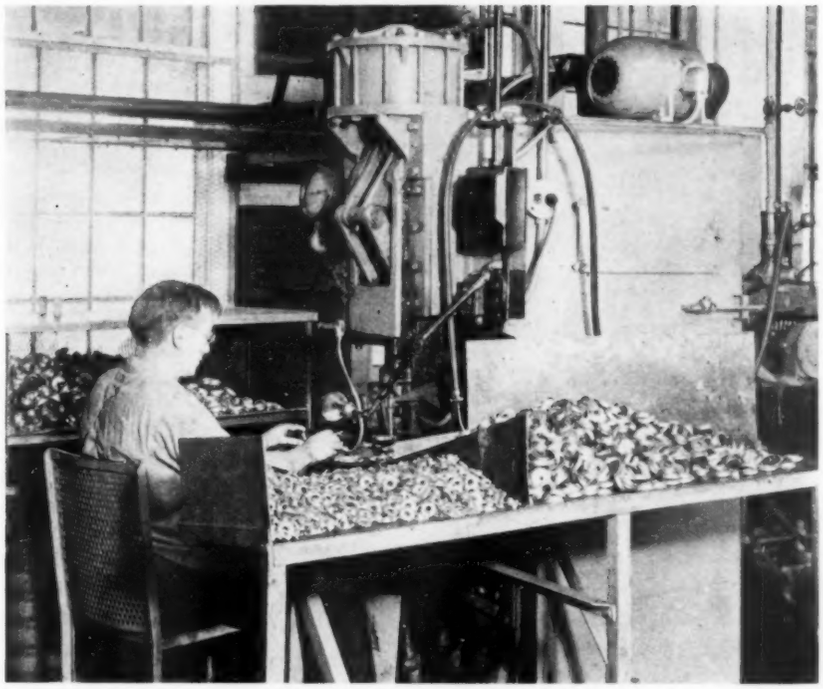
My first reaction is that all the government departments should be abolished. Let's start with the Constitution and the Supreme Court minus the Ku Klux Klan, then perhaps we could have the decks clear enough to reorganize the government intelligently.

On second thought, perhaps it would be well to continue the Post Office, but instead of having a political racketeer to head that department, allocate one of the Supreme Court Justices to administer the department on his vacation time during the months of June, July and August. Perhaps too, we have need of a Commerce Department, but let's start on an absolutely clean slate and get a No. 1 business man to organize it. And perhaps we do need the War Department and the Navy Department; after all, they are a pretty good bunch of fellows, and comparatively speaking, their administration is not too bad. We might also purge the Department of Agriculture of the AAA philosophy.

The above may sound like a jest, but I am really telling you it all in the utmost seriousness.

PHILIP M. MORGAN
Treasurer
Morgan Construction Company

First part of this symposium was printed in (*AM* Vol. 81, pages 1250 and 1251)



Adjusting gears and dirt covers are brought up on both sides of the operator for assembly by projection welding

They Make Their Own Brakes

Driver safety is a prime consideration in Delco's mass production method of manufacturing brake cylinders

A. L. WARD
Factory Manager, Delco Brake Division, General Motors Corporation

WHEEL AND master cylinders for hydraulic brakes for General Motors cars are built by the Delco Brake Division of the corporation at Dayton, Ohio. Modern equipment, including unique and highly efficient special machinery designed by Delco Brake engineers, is used in making these cylinders. There are four main production lines, each starting with the machining of the master or wheel cylinder bodies and progressing through inspection and assembly to final assembly and packing.

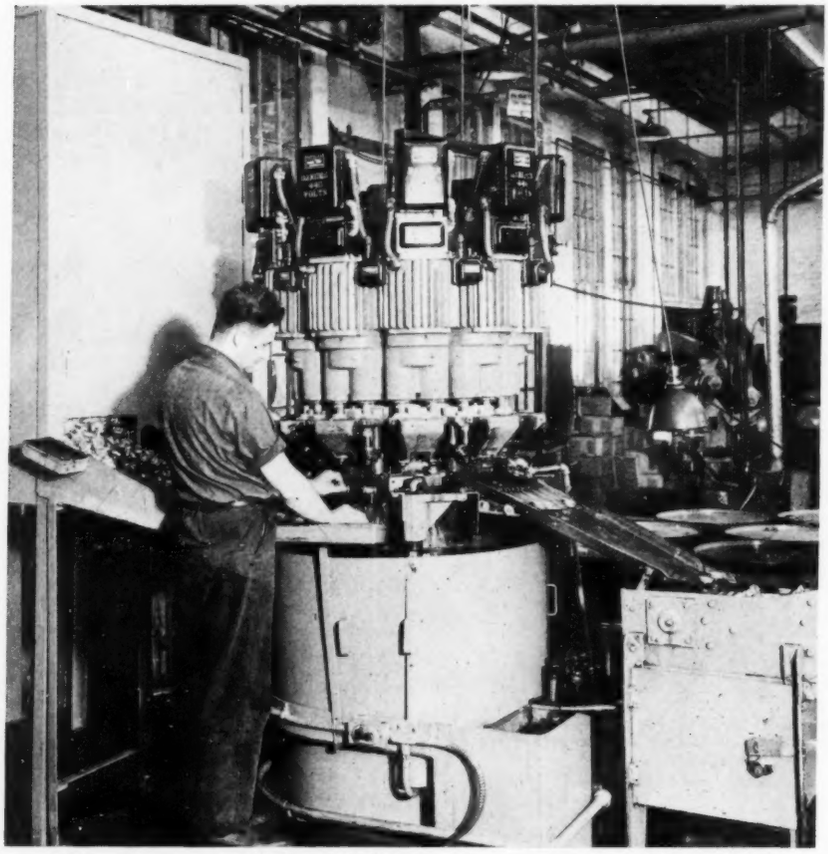
In addition, there are four feeder departments for stampings, miscellaneous machined parts, sub-assembly, and heat-treat and plating. This article describes the production of wheel cylinders, while a subsequent article in an early number will tell how master cylinders are fabricated.

Two general types of wheel cylinders are produced. One, known as the adjustable type, has on each end a combination dirt cover and adjusting gear, while the other, known as the boot type, is used on brakes having a separate adjustment. These two general types have many variations in themselves. They vary in size to give proper relative braking pressure, and the mounting and connecting hole designs are varied to meet assembly requirements on the automobile.

Gears Are Stamped

The series of operations in the feeder department producing gears and covers are as follows: The gears and covers for the adjustable type wheel cylinders are made on a precision, roll-feed dieing machine with a capacity of approximately 100 strokes per minute; the set-up includes a stock reel and stock straightener, synchronized to better the feeding of material to the press. Gears and covers are produced on separate dies, the die for the gear presenting the greatest difficulties because of the extruded center hub which, in the assembled wheel cylinder, is a vital part of the blade mechanism.

This gear is stamped on a progressive die from coil stock, the stock being mounted on a feed rack and proceeding through the straightener and feed rolls into the die. In the first stage, the strip is pierced to allow each of the three positions to draw independently in the second or drawing stage. In the third and fourth stages, the dome is pierced and extruded to complete the hub, while in the last stage the gears are blanked through the die onto a conveyor which carries them into a rotary wash-



Gear and cover assemblies are fed from a hopper, pass through a ten-head continuous tapping machine and are discharged via the chute at the right

ing machine, from which they are dumped into tubs, ready for welding to the cover.

The welder for assembling the adjusting gear on the dirt cover is a resistance type projection welder equipped with an index dial. After welding, the parts are blown from the nests in the dial by air into a hopper, where they are inspected before being sent to the plating department. In the plating department, these assemblies are given a zinc plate with a dichromate finish, the operation being performed in an automatic, barrel plating machine with a single handling. This machine is equipped with eleven separate tanks for the various cleaning and plating solutions, the tanks having a combined capacity of 23,000 gallons. There are 23 revolving barrels which progress from the loading position, progressively raising and lowering from one tank to another until the cycle is completed and the parts unloaded.

After plating, the gear and cover assemblies are threaded on a specially designed, continuous tapping machine equipped with ten heads, each driving two tap spindles. The whole upper part of the machine, carrying the heads and locating fixtures, rotates continuously. As each head passes the loading position, the tap starts to feed into the work, going through, then reversing and backing out, after which the part is unloaded automatically just before reaching the loading position. This machine has a net production of 3,600 pieces per hour, tapping a $\frac{1}{2}$-20 hole $\frac{5}{8}$-in. through. The parts fall from the tapping machine to a conveyor and are carried through a degreaser to remove the heavy oil used in tapping, after which they are ready for final assembly on to the wheel cylinder.

All cylinder castings are transported from local foundries in large tubs which are placed at the head of the machine lines. They are hoisted, as needed, by an electric hoist onto movable, inclined racks and moved to the first operation machines. A door is opened at the lower end of the tubs, allowing the castings to feed out on the table from which the operator feeds the machines. Special platforms for the operators are necessary to facilitate the loading of the machines, as well as the handling of the material.

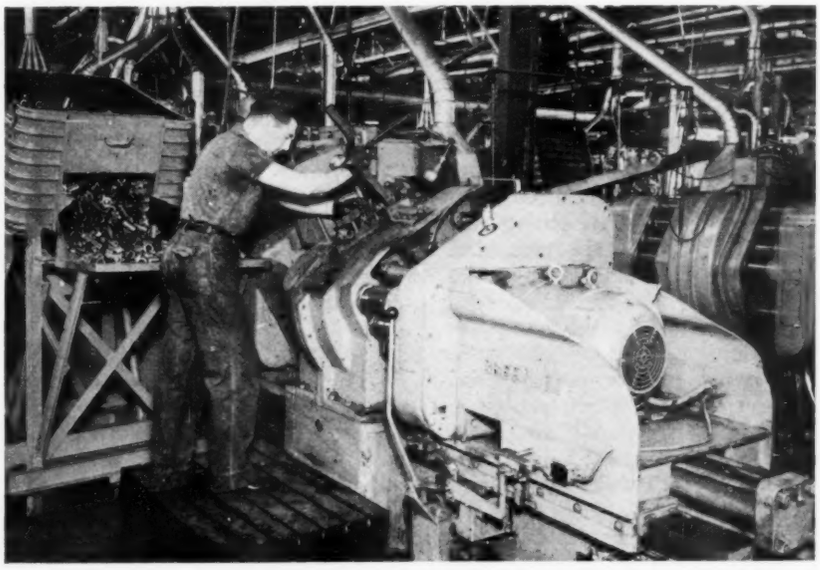
Machining the Cylinders

The machining of the adjustable type wheel cylinder bodies is started on large, double end, horizontal index machines having twelve spindles on each head. The bodies are bored, reamed, turned on both ends, and faced and chamfered, four castings being machined in each index position. The working positions of this machine are as follows:

The first position drills half way through from both sides and chamfers the hole, rough hollow mills the O. D. on each end and rough faces each end.

The second position passes a second drill through from one end and finishes hollow milling, facing both

Tote boxes carrying cylinder castings are hoisted on inclined racks to bring the work up to the first operation on double-end multistation boring and facing machines



ends as well as chamfering the outside corner at both ends.

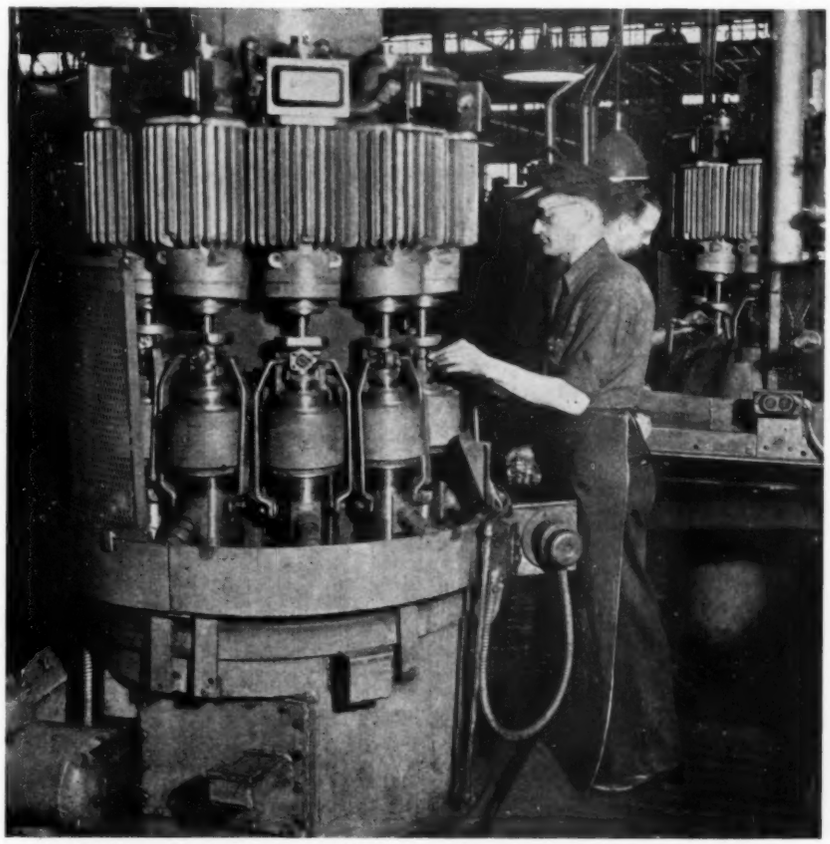
The third position takes a boring cut through the center of the hole and chamfers the O.D. of both ends.

On the fourth position, the parts come to the operator unclamped, ready for removal. From this operation, the castings are placed on a conveyor which carries them through all machining operations.

The next operation of turning and facing the mounting tenon, drilling and tapping the mounting holes, and drilling and spot facing the spring clip hole is done on specially designed index machine. It is a type used for about 60 per cent of the machining operations in the plant. It has six vertical, independent, motor-driven units, mounted on a circular base around a large index table, carrying seven fixtures, each fixture holding four cylinders. The last of the six units is a tapping unit, and the other five are drilling units. Each unit has two motors, one for operating the feed cam and the other for driving the cluster box.

Diamond Bored

After this operation, the cylinders pass through three machines of the same type as above where the bleeder screw hole and dummy screw hole are drilled, counterbored and tapped, and the connecting hole drilled, faced, serrated and tapped. They then move down the conveyor to the continuous diamond boring machine, which is designed along the same general principles as the continuous tapping machine already described. Each of the ten heads on this machine carries one diamond boring bar. The machine has a net capacity of 1200 pieces per hour.

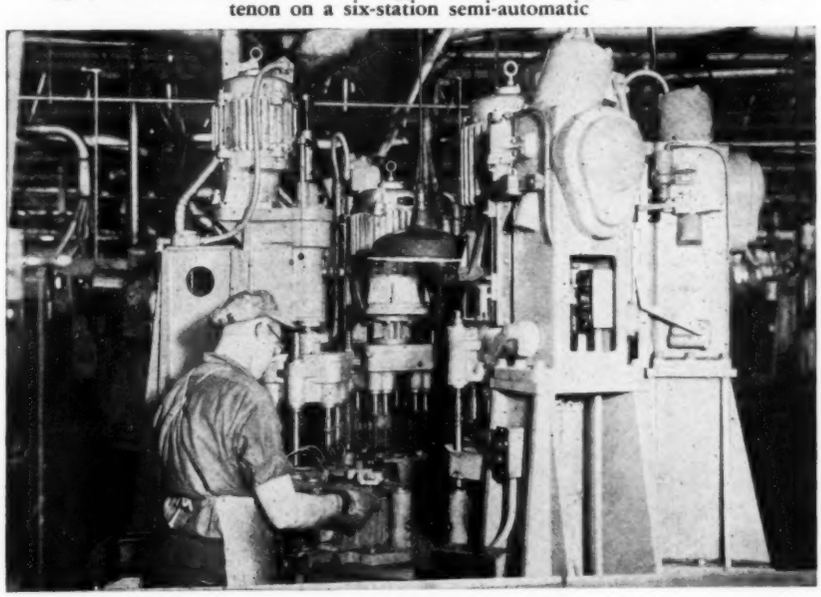


Each of ten heads carries a diamond boring bar, contributes to a capacity of 1200 cylinders an hour

At this point the cylinders are washed, bearingized and rewashed, then carried by overhead conveyors to the inspection bench.

As the cylinders come from the machine line they are given a 100 per cent inspection. This includes sight inspection, with particular attention given to threads, and checking the piston bore on an air arbor. This arbor is made to correspond with the low tolerance of the bore. One end is hollow, and several holes are drilled around the circumference of the other end. These holes are located in the groove about $\frac{1}{4}$ in. from the end and are connected with the hollow center. The arbor is connected to the air line, and the air, entering at a definite pressure, passes through the hollow end and out through the holes. A master ring gage, made to the high tolerance of the cylinder bore, is used to regulate the air presure passing through the holes.

Sixty per cent of Delco's operations are done on machines of this general type; that illustrated shows turning, drilling and tapping the mounting tenon on a six-station semi-automatic



Pressure Shows Fit

When a cylinder is tested on the arbor, its pressure must check closely with the reading obtained when the ring gage was used. If the cylinder does not fit on to the arbor, it is known that the bore is too small, but if it does fit, and the pressure is not as high as that of the ring gage, the bore is oversize.

After inspection, the cover spring is riveted in place, the bleeder valve from sub-assembly is inserted, and the dummy screw with its washer is

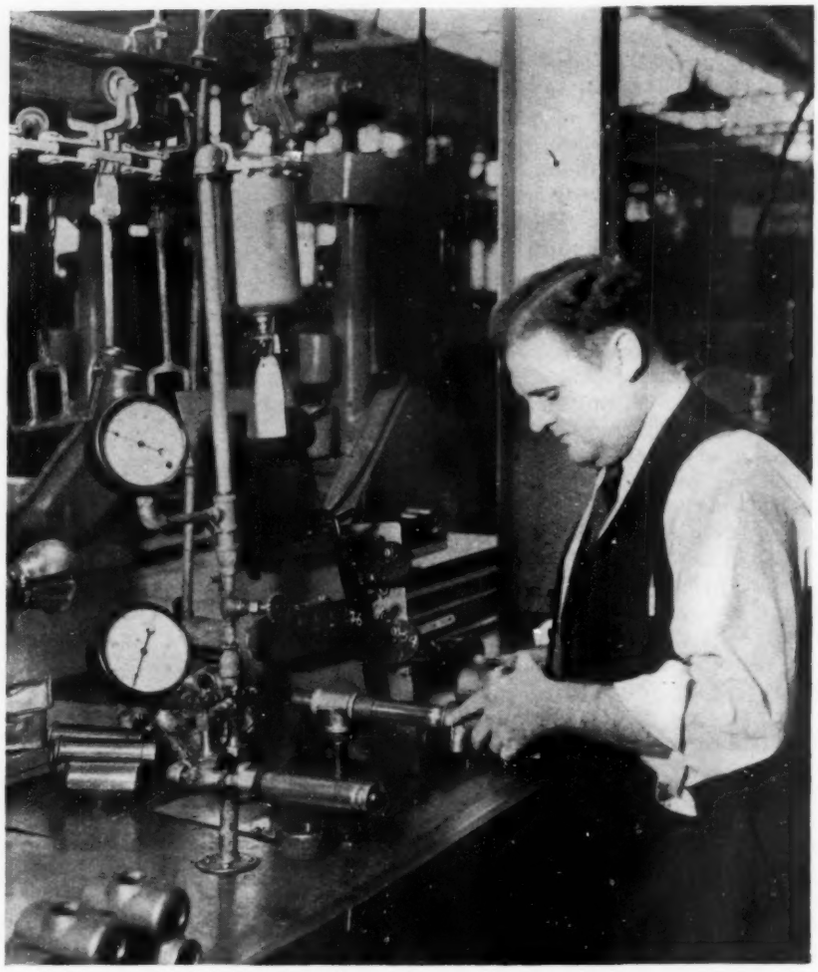
driven to place. The body is then washed in alcohol and the piston bore castor-oiled.

Two piston cups, two pistons and the spring are assembled and held in place by a spring clip, and the assembly air-tested for leaks. The cylinders are placed in a fixture and immersed in alcohol. Air is forced into them through the inlet hole at 80 lb. pressure, and any leaks are detected by bubbles in the alcohol. The fixture prevents the pistons from blowing out under the pressure.

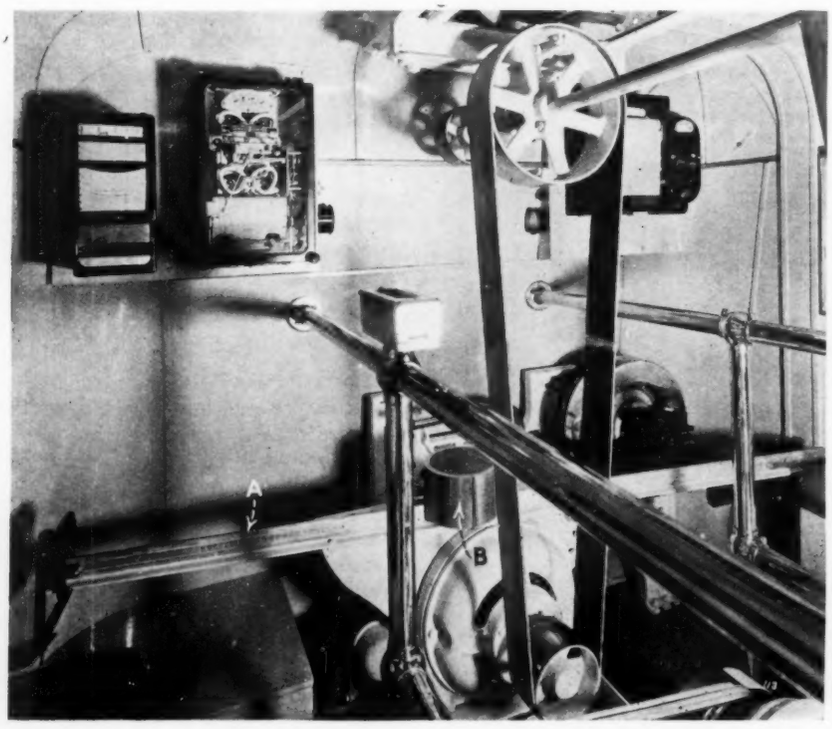
If no defects are found, the clip holding the assembly together is removed, the gear covers placed on each end and the clip replaced. After the covers are on, the adjusting screws are driven in, the thread protector installed, and the cylinders packed for shipment when inspected.

Boot-Type Cylinder

One operation on the boot-type wheel cylinder body is worthy of mention. These cylinders do not have faced and turned ends, and the piston bores are finished complete from the rough on batteries of three-spindle diamond boring machines. These machines have long-piloted boring bars, with two integral cemented carbide blades for roughing out the core, followed by an adjustable diamond boring bit, finishing the hole. Other operations on this cylinder are like those on the adjustable type.



Air pressure applied through orifices in an arbor indicates the size of the cylinder bores



Now on tour, Graton & Knight's mobile laboratory tests the comparative merits of various grades of flat belts and demonstrates the efficiency of group drives. At the left is shown the set-up for testing flat belts. Scale beam *A* is attached to a yoke on the motor frame and is pivoted at one end; weight *B* is moved to change the tension on the belt. The motor is leveled and wedged in place to maintain a constant center distance between the pulleys. The power transmitted by the belt is recorded on the instruments illustrated. An impartial test is given each belt

TALKING SHOP

The Micro-Inch

There is progress in the measurement of surface quality. But it isn't an exact science, or with recognized standards as yet. Surface measuring machines are in use, however, in some of the large automobile plants and have reduced costs in several instances, by proving that it did not pay to have the first cuts as rough as formerly. By controlling the roughing cut surfaces the cost of finishing can be appreciably reduced. E. J. Abbott has built machines that measured the depth of surface scratches very accurately to one-millionth of an inch. He suggests calling this a micro-inch. But already some are confusing it with "microns," which are one-thousandth of a millimeter, which is very different. It would seem better to get a term which cannot be so easily confused.

Foremen and Fatalism

Shop accidents, according to one "safety man" are partly because of carelessness due to fatalism on the part of the men. In his opinion about 25 per cent of shop accidents can be traced to carelessness due to this attitude. Lack of safety qualifications on the part of foremen are responsible for as many more. For, in this man's opinion the foreman

is the real "safety man" in any shop. The safety engineer can provide safeguards and specify safe practice but only the foreman can see that devices are used and rules observed.

As an example he cited a foreman who lost a finger by failing to observe a supposedly iron-clad rule against cleaning a machine in motion. In another plant equipped with *two* hand release levers on its punch presses, one lever was wired so that only the other hand was needed to trip the press.

Holding the foreman responsible for careless practices, usually has its effect on accident reduction.

Not What We Know!

Glenn Gardiner told a good story during his talk on job training at the A.S.M.E. There was a book agent who was trying to sell a farmer a set of books that would help his output of produce. "If you follow

these instructions you can double the amount of stuff you raise. You can't afford not to have these books."

But he couldn't get his name on the dotted line. "Young feller," he said, " 'tain't no use my buying those books. Sure I might learn something. But darn it all, I ain't using half what I know already." All too many of us could say the same thing, if we were as frank as the farmer! It isn't so much what we *know* as what we *do*!

Color in the Shop

Are shop workmen influenced by their surroundings? Inland Manufacturing Division of General Motors thinks so. It recently has installed a new department to produce automobile clutches. All of the machinery along the production line has been painted an attractive blue. All sheet metal in the shop has been done in silver. This blue-and-silver combination provides a cheery atmosphere in the shop and makes the shop lighter. It has a psychological value for the men which the management thinks important.

Tool Marks and Failures

Methods of detecting cracks have come a long way in recent years. The use of a thin coat of whiting has long been a railroad method of testing. On old axles and other parts it was usually considered that there was enough oil in any crack that might exist to show through the whiting. If there was any doubt in the matter, the piece was dipped in kerosene or other penetrating oil, before being coated.

Magnetic methods are even more effective and show up cracks that no one dreamed were there. Many of these cracks are believed to start from tool marks made when the piece was machined. Complete recognition of this may lead to greater care in rough turning, or at least in being sure that there are no tool marks on the finished piece. A finish that might be satisfactory as to appearance may contain tool marks or scratches that can lead to failure in service—which makes another real problem for the man in the shop.

No Orders Wanted

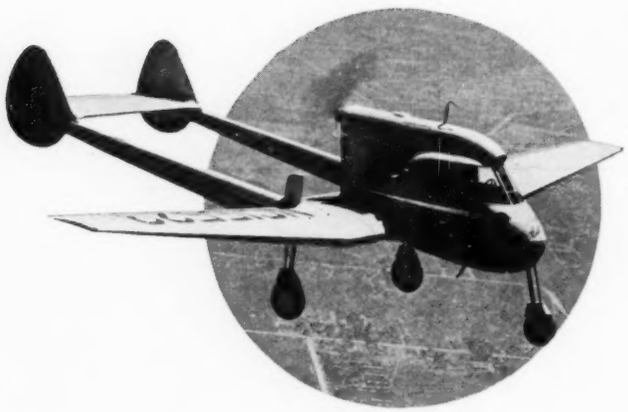
It isn't enough now days to have your brow creased by the worries of decreasing orders. The latest story comes to us from the general manager of the Blank Printing Press

Company. He has been struggling for several weeks to keep his men employed in the face of diminishing new orders.

His last blow was to find that some of his employees were spreading the story that "Business" caused the present recession to spite the administration, and that the Blank Printing Press Company was aiding by refusing to accept orders!

Possibly this situation might not have arisen at all if it had been the practice of this general manager to take his employees into his confidence as to the actual state of the business, or at least as to orders on the books.

The Editors



Stearman-Hammond "Y" airplane selected by Department of Commerce as safest yet built for the private pilot

Kopek photo from Gilmore Oil Co. plane

Jig and Hand Operations On the "Safest" Plane

Production technique selected for the Stearman-Hammond "Y" plane for the private pilot rules out mass production methods because of the small lots involved

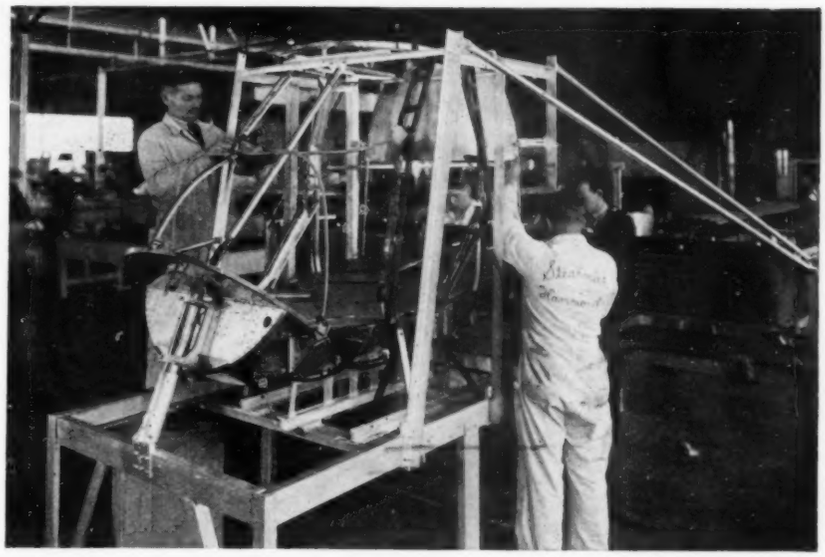
LLOYD STEARMAN
President, Stearman-Hammond Aircraft Corporation

WE ARE NOW in production on the Stearman-Hammond Model "Y" airplane in our South San Francisco factory. A simple statement—but what a history, and what a headache there is behind it! For the Model "Y" multiplies the production problems of the conventional airplane. Or perhaps we should say that being unconventional in design it calls for a new production technique. Now that we have developed that technique we have reason to hope that we shall achieve much greater efficiency in production.

The Model "Y" has been widely hailed as the "newest thing in the air," "everyman's plane," the "answer" to the problem of safety in private flying, etc. In this age of streamlined press-agentry it is small wonder that popular writers on aviation subjects have let their imaginations run riot when coining phrases to fit the plane that was selected by the United States Department of Commerce as the safest yet built. But to those of us who have toiled through the mechanics of putting this airplane into the hands of the ultimate consumer the pretty phrases have at times proved noxious. We have in private frequently found stronger and less quotable phrases more satisfying to the ear. For the Model "Y" was of necessity a functional design which must disregard many engineering short-cuts to production economies which a more conventional design might have utilized. The original design as developed by Dean B. Hammond and his assistants was based primarily on aerodynamic specifications which the bulk of the aviation industry called impossible. To meet the requirements of the U. S. Bureau of Air Commerce, Hammond had to develop an airplane with greatly improved vision, with no tendency to spin under any condition of flight, with the ability to land in cross winds and under other conditions not possible to conventional planes, to taxi along the ground when other planes would be held in their hangars by too-lively air currents, and yet this plane must have unusually good

Tail fin assembly jig. Metal sheets formed by drop hammer, upper tip by hydraulic press, channel sections in a brake, leading edge by hand. All parts riveted together

Precision jig in which cabin portion is assembled. Parts are fitted and riveted by hand, alignment assured by the jig



Photographs by Clyde H. Sunderland

performance in speed, climb, cruising range, etc. Impossible as these requirements seemed, they were met satisfactorily.

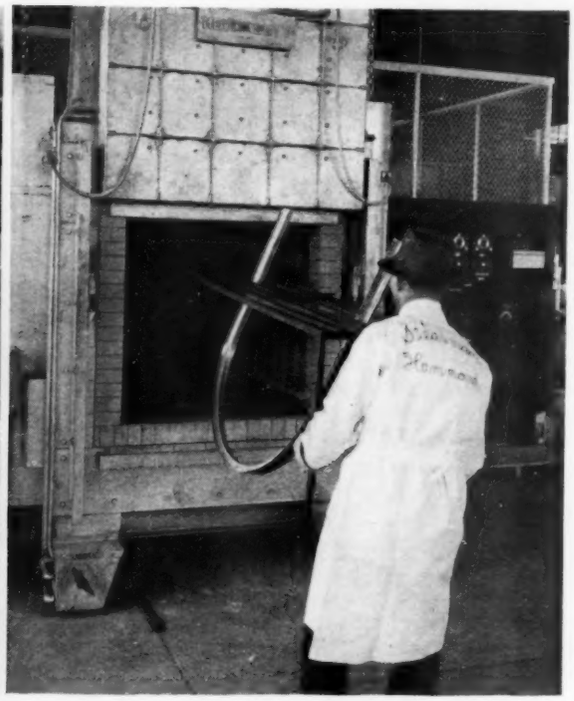
For functional reasons of design it was necessary to use a tricycle landing gear, a twin boom twin rudder tail, a pusher location of propeller. Although the airplane is of all-metal construction, design requirements dictated use of a cloth covered wing. Primary structural material is sheet aluminum alloy, though steel is used for the engine mount and landing gear struts.

In general design the Stearman-Hammond Model "Y" is a cantilever low-wing monoplane with a stubby cabin nacelle accommodating two people seated side by side, and with the engine mounted in the upper rear portion of the nacelle driving a pusher propeller. There is no fuselage, the tail being carried on two booms extending from the main wing structure. The landing gear, known as the tricycle type, provides two wheels under the wing and in rear of the center of gravity, with a third wheel up front under the nose. This arrangement permits the machine to sit level on the ground when at rest, instead of being cocked back on its tail, and has numerous advantages in connection

Multi-cellular monospar wing under construction. Corrugated sheet cap strips carry major stresses. Upper and lower sheet sections and central spar are assembled in separate jigs and then combined

Stearman-Hammond shop showing predominance of hand operations controlled by special jigs

Not much machining is required for the Stearman-Hammond "Y". An aluminum alloy casting used in the control system



Aluminum nacelle bulkhead channel being heat-treated for maximum strength

with taking off, landing or taxiing along the ground.

In placing the Model "Y" in production we gave the most careful study to methods of metal working developed to date. Since formed aluminum sheet has become the leading structural material used in the manufacture of American planes it is of interest to note the various methods developed to work the sheets into required form. Oldest is simple hand forming, working with hand tools to fit the metal sheet to a wood form. Then there are several types of hydraulic presses, there are a number of crowning devices for forming pieces involving simple double curvature, and there are the drop hammer processes with their zinc and lead dies. In selecting the method to be employed it was considered vital to balance it with probable production. That is, if only ten pieces are to be formed the hand working process will be cheapest, but if a hundred or so are to be made it will usually pay to make the necessary dies and have the piece stamped out in a drop hammer, or pressed out in a hydraulic press. Then there is the problem of whether to install complete drop hammer or press equipment, or to subcontract the manufacture of certain parts to firms equipped for drop hammer work.

In our case the decisions made were based on the same theory of compromise that had governed the design itself. A careful study of methods and an impartial decision in each case brought about our decision to farm out the drop hammer stamping of the parts formed by this process, which were few. But we built our own hydraulic press for forming numerous parts such as the air intake scoops, rear boom ends, parts for the fuel tanks, tips for the vertical fins, etc. In this press we use either a male or female die and form the part by pressing the work into or over the die with a thick rubber mat. This process is relatively slow, but it is also relatively inexpensive. Parts formed in this manner must require only shallow forming, as the press cannot develop the deep and intricate sections turned out by the drop hammer process with its male and female dies and also multiple dies.

Then we found that quite a number of parts could be made most economically by hand forming. For example, certain bulkheads of which there are only two per airplane. These parts are small and easily formed. As it would take several hundred parts to pay the cost of die equipment, the hand operation is the answer. It always must be remembered that production of airplanes must be dealt with in terms of hundreds, at best, instead of thousands and multiples of thousands as in the automotive industry.

Economy or production volume does not always govern choice of method used for metal working. In the fabrication of our wing spar it was important that the corrugated top and bottom flanges should taper the corrugations to match the taper of the spar itself. These corrugated flanges were formed by the drop hammer process as the most satisfactory way of getting the required part.

In designing our wing ribs we found that maximum strength-weight ratio was accomplished together with certain other advantages, through building the rib of hollow square aluminum tubing fabricated into a truss structure. But it was impossible to rivet this structure by the usual method using pneumatic riveters without crushing the tubes. So we used rivets, but they were set with a rivet spinner chucked in a drill press, thus retaining the desirable square tube material in its most efficient form.

Although the landing gear struts are of chrome-molybdenum steel and require some machine work, most of the machining operations on our plane are on aluminum castings. But even the aluminum castings are not widely used and so machining is at a minimum.

Welding is not used to any appreciable extent either, being confined mainly to the welded steel tube engine mount structure which

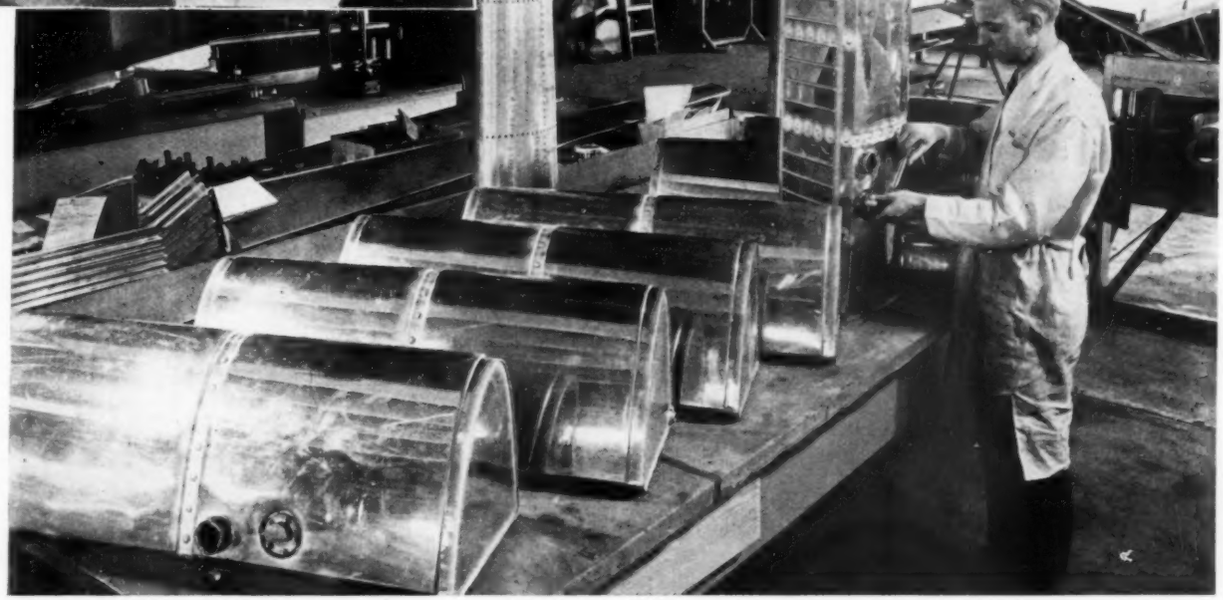
rests directly on the main wing beam. There is one unique bit of welding used on the plane in connection with attaching steel filler necks to the sheet aluminum fuel tanks. There are two fuel tanks per plane, forming an integral part of the center section leading edge of the wing and each being attached to the main spar structure by means of three aluminum alloy straps. By first heavily cadmium plating the steel filler neck it is possible to weld it directly to the thin aluminum sheet of the tank with ordinary aluminum wire as employed in any conventional aluminum welding. The only special precaution required is not to burn away the cadmium plating in welding. By welding the steel and aluminum together the problem of corrosion through electrolysis is eliminated, though this is a major problem in aircraft structures where dissimilar metals come in close contact but are not electrically bonded together.

Riveting is used throughout the plane as a means of fabrication, except at points where attachment of the outer wing panels to the center section is by means of bolts, and where assemblies or accessories are attached by means of screws or bolts.

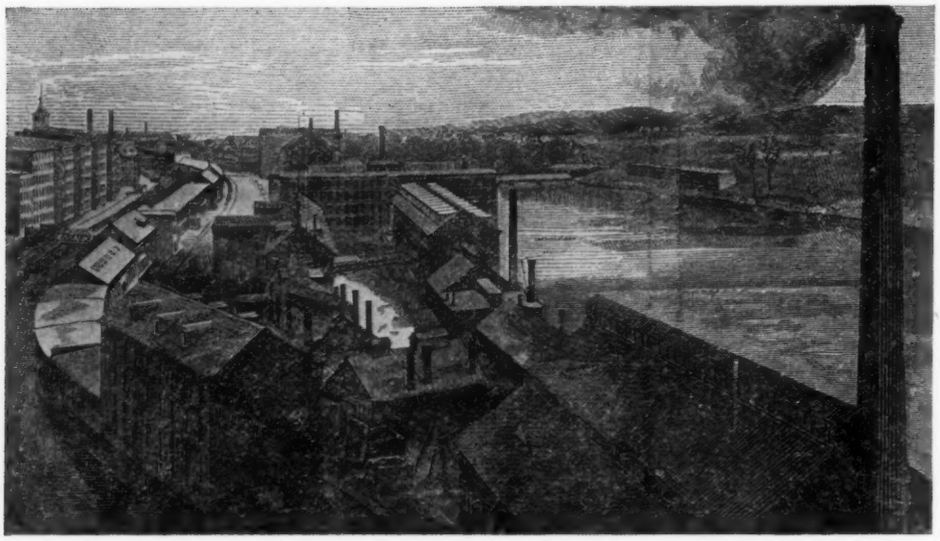
In assembling the structure we have developed the jigging technique to a fine point. Not only does a well designed assembly jig insure accuracy of the part, assembly or completed machine, but it greatly speeds the work and so usually pays for itself many times over. On the Stearman-Hammond "Y" we have used a series of jigs which in a sense serve as a production line. Thus the wing rib is assembled in one jig, the spar cap strip in another, the main wing spar in another, and the final wing structure in a jig of its own for either the left or right wing panel. In the meantime we have jigs for the rudders, fins, stabilizer, center section, etc. The booms on which the tail is carried are assembled in three separate jigs for rear, center and forward portions, and are then joined in a master jig. The main wing center section and nacelle are assembled in a master jig, but the forward portion of the nacelle is assembled in a different jig and then moved to the main nacelle section and attached. Of course the engine mount is assembled in a jig of its own, as is the engine cowling. Some of these jigs are rotatable for easy riveting, as in the case of the fin jigs. While most of the jigs are built up of steel, some are mainly of wood, as in the case of the main tail boom jig, which is built of wood, with steel end sections to insure accuracy of the portion of the boom which must mate with other parts of the plane. Use of wood for this jig serves to reduce scratching.

It will be obvious from this review of our fabrication methods that the quantity production methods of the automatic machine industry have not yet been adapted to the field of aviation, even in connection with an all-metal plane which has been enthusiastically called "as modern as tomorrow" by some of our better word warblers. Our hope of lower costs rests largely with gradually increasing production, continual development of efficient jigs and other assembly methods, etc. The day has certainly not yet arrived when airplanes can be poured in multiple molds and set out in the sun to dry.

For hand work of this type good tools and expert workman are essential



Aluminum fuel tanks designed to form the leading edge of the wing center section. A steel filler neck is welded in



The old big shop of the Amoskeag Manufacturing Company

Amoskeag and Its Historic Lathe

One of the famous old plants at Manchester, N. H., built locomotives and steam fire engines during the last century, and some of its time-worn equipment is still in existence

FRED H. COLVIN
Editor

AMONG THE OUTSTANDING shops of early New England, the machine shop of the Amoskeag Manufacturing Company at Manchester, N. H. comes very near the head of the list. Built in 1840, beside the lower canal, it had a length of 256 ft. but was only 36 ft. wide. This shop was added to in 1848 by a new building of the same length but 4 ft. wider and three stories high. Although built primarily for the building and repair of textile machinery and turbine water wheels, it turned out a variety of products at different times.

That Amoskeag was among the early builders of locomotives is shown by a recent publication of the Railway and Locomotive Historical Society dealing with locomotives of the Chicago, Burlington & Quincy railroad. This shows that the first locomotive of this road was received from Amoskeag in 1851 and that it was No. 29. The second locomotive, according to data supplied by Manchester historian Fred W. Lamb, who formerly worked in the old shop, was completed on June 27, 1849. There was no exact record of the first, which was finished earlier in the same year. These locomotives must have been very satisfactory for the records of the C.B.&Q. show the purchase of 25 of them between 1851 and 1853. Amoskeag built 232 locomotives in all, before going out of the business, and it was followed by the Manchester Locomotive Works, which was one of the original units in the formation of the American Locomotive Works many years later.

A few years later, during the winter of 1858-1859, the first Amoskeag steam fire engine was built. Over 500 of these, including some of the first self-propelled fire engines, were made before they were abandoned. Amoskeag also made from 1,500 to 2,000 rifles per month during the Civil War. Here, too, in 1868, James S. Batchelder, a native of London who came to Manchester in 1843, built a steam-driven road vehicle, one of the numerous forerunners of the present-day automobile.

The first Amoskeag self-propelled fire engines were driven by a single chain to the right rear wheel. While this met with fair success the city of Detroit evidently demanded a drive to both wheels on its engine ordered in 1873. Steering difficulties developed which were finally solved by the introduction of the "differential" in the rear axle. This differential was an adaptation of what had been known as a "compound" which had been used on cotton

speeders for years, but evidently never before applied to vehicles. These compounds date back to 1822 but N. S. Bean, superintendent of Amoskeag, patented its application to vehicles on Dec. 27, 1874.

For Large Pulleys

In order to secure desired speeds from slow-moving steam engines or water wheels, large driving pulleys were necessary. And turning and boring these pulleys necessitated a large lathe in the shop. So, in about 1851 the lathe shown was built in the Amoskeag shop for its own use. This is what was known as a pit lathe, consisting of a headstock, with its spindle nose projecting over a pit large enough to swing the largest pulley to be used. On the other side of the pit, at right angles to the spindle, was the bed that carried the tool slide as can be seen. The pit in this case swings 33 ft.

The faceplate of the lathe shown here is 21 ft. in diameter and about 8 in. thick at the outer edge. The weight is estimated at 5 tons. Shop history says the faceplate was made in Cambridge, which makes one wonder regarding its transportation to Manchester. One theory is that it was pulled by horses on a drag from the foundry to the canal in Boston and taken by boat to Manchester. This is especially interesting because the transportation problem is said to stand in the way of the shipment of the lathe to the Ford Museum in Dearborn, Mich. The only method seems to be to cut the faceplate with a torch and weld it after it reaches its destination.

One of the historic jobs done on this lathe was the turning of the large brass rings used for turret tracks on the early monitors. The McKay Works of Boston sent the rings to Manchester to be turned as there was no other lathe large enough in all New England.

A general view of the old lathe is seen in Fig. 1 with about a 16-ft. double arm pulley strapped to the faceplate. The tool carriage has sufficient cross travel to reach the rim of the largest pulley or fly wheel that will swing in the pit. The long ram enables it to bore a deep hole or turn a face of considerable width. It is set up for boring the pulley hub.

Power feed for both motions is through the pulley on the end of the tool-block feed screw. It takes four pairs of bevel gears, two universal joints and a worm and worm gear to get the power to the cross-feed screw. Hand feed for the carriage along the bed is through the handwheel over the bed and suitable reduction gearing. Clutch connections on the screw in the tool ram permits either cross feed, or in and out feed, to operate at will.

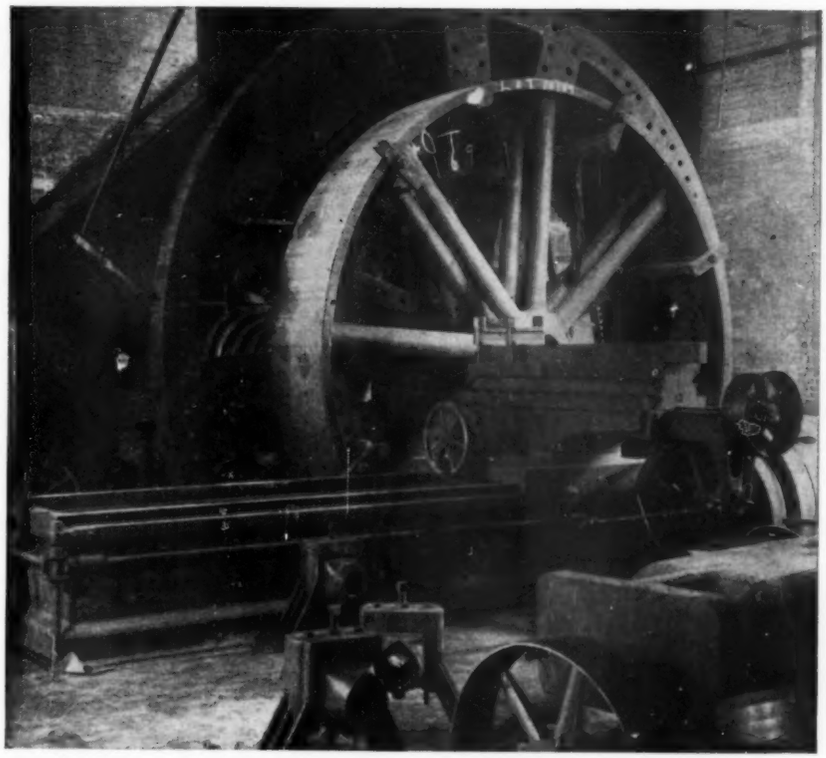
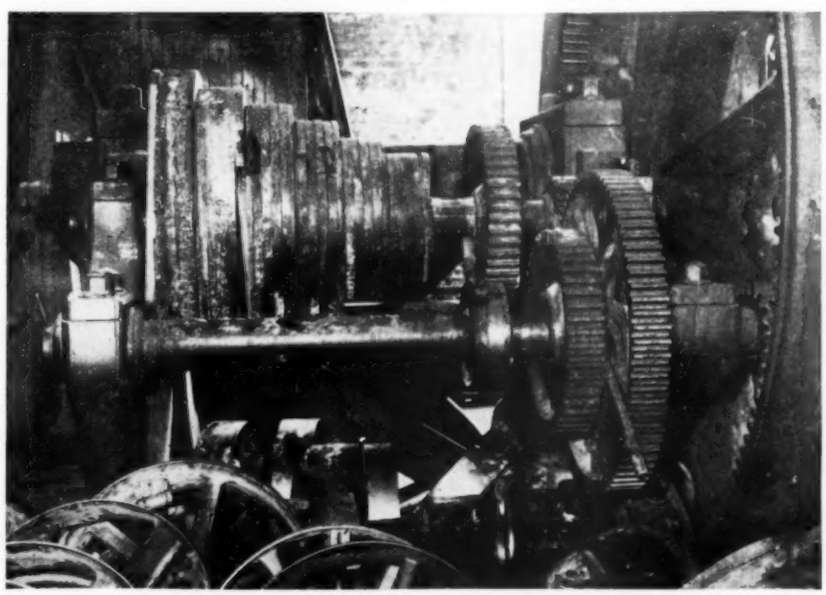


Fig. 1—So big as to be a problem to ship to the Ford Museum at Dearborn, this pit lathe of 33-ft. swing stands as a mute tribute to the skill of bygone generations

On the back of the faceplate is a projecting ring that carries the large internal driving gear shown in both Figs. 1 and 2. Power comes from the six-step, built-up wooden cone, through reduction gears. As shown the slow-speed gear is in place. Sliding the gears in front to the left engages the other gears and gives another set of six speeds. The driving mechanism is entirely separate from the main spindle which has bearings all its own. All bearings, however, are substantial, and the fact that the lathe is still serviceable after over 80 years of use is an indication of the designing ability of those in the long ago.

Fig. 2—A six-step built-up wooden cone drove through reduction gearing to the ring gear at the back of the faceplate



About Malleable Castings

Speed-up in annealing of malleable castings is only one factor which has brought this material again into the limelight

THE PRODUCTION of malleable iron castings has shown a healthy increase during the past four years. In 1936, production totalled 665,000 tons. Reports for the first half of 1937 revealed that operations are at 73 per cent of capacity, and are running about sixteen per cent ahead of last year. It is of interest to note that in 1936 approximately 56 per cent of the entire output of the malleable industry was used in the automotive industry. Approximately 100 lb. of these castings are used in the construction of the average automobile.

Not only has the industry reflected the general business improvements, but an active program of research and development work has been carried on within the industry and has done much to improve its position.

Manufacturing methods have been improved and new and modern equipment adopted. Perhaps the most outstanding improvement in the malleable iron field is the improvement in annealing methods. Ten years ago the average annealing cycle was around eight to ten days. Today, with improved equipment and improved technique, many plants are annealing in four days and a few have so perfected their methods that they can anneal castings in 36 to 48 hours.

Effective advertising of the qualities of malleable iron castings have done much to improve the amount of output. Uses of the material has become more widespread and new uses are being developed regularly.

Another reason for the ever growing acceptance of malleable iron as an engineering material is to be found in the physical properties of the metal. Malleable iron castings have good resistance to shock and vibration. The material has a tension yield point of approximately 36,000 lb. per sq.in. It machines readily, possesses good corrosion resistance and may be painted, galvanized or plated. This gives the product usability and durability in any kind of climate and under severe punishing conditions. The combination of strength and excellent machinability of malleable iron is its greatest asset. Another feature of the material is that machining operations can be reduced to a minimum due to the fact that malleable iron may be cast very true to pattern.

Three examples in which malleable castings were used to replace unnecessarily heavy and costly assembled units with consequent economies are demonstrated in the accompanying illustrations. In all cases a single malleable iron casting replaced intricate assemblies of other materials.

Fig. 1 shows a single malleable iron connecting rod which replaced an assembly of two gray iron castings, two pieces of bar iron, five bolts, one forging and also eliminated the drilling of eight ½-in. holes. The weight saving in this case amounted to nearly sixteen lb. without sacrificing any strength.

The malleable iron implement hitch shown in Fig. 2 permitted the elimination of a built up unit made from four pieces of rolled angle steel. The assembly of these pieces required 22 punched holes and four rivets. The weight saving totalled 2¼ lb.

A malleable bracket replaced the assembled bracket shown in Fig. 3, which consisted of six rolled steel angles, one gray iron casting, one special bent bolt and nut, four machine bolts and nuts and four rivets. It eliminated the necessity of drilling 26 holes and weighed 8 lb. less.

Weights of built-up assemblies are reduced by proper application of malleable casting technique

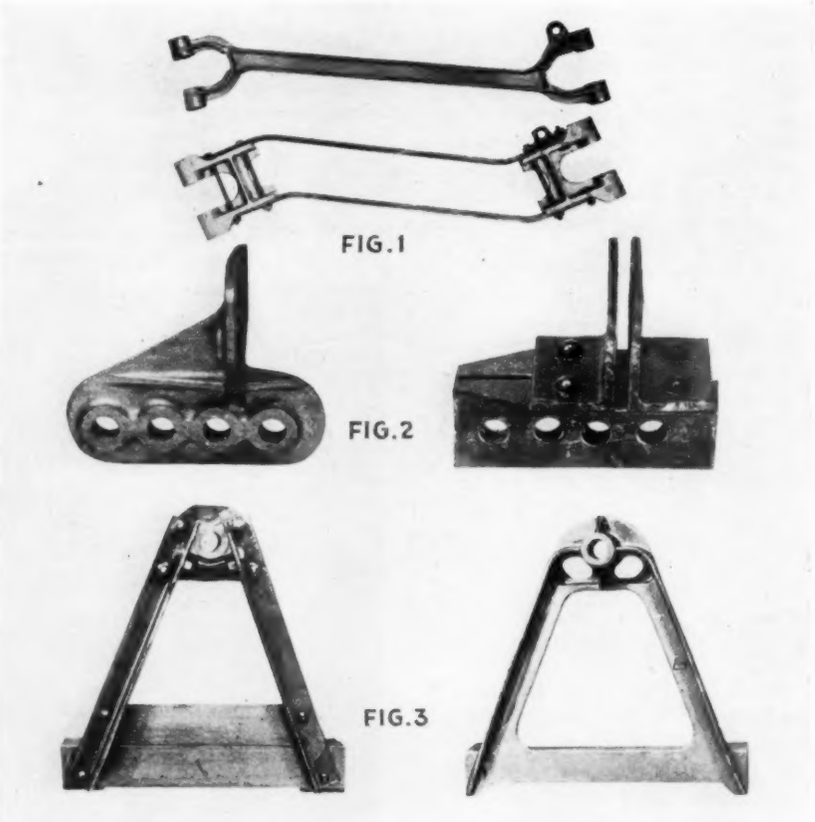


FIG.1

FIG.2

FIG.3

ROUND TABLE

Better or Worse

"Something's got to be done about this spoiling of work," said Al, as he was talking his shop problems over with Ed, "and I've just about made up my mind what it is."

"Your pet peeve, again," noted Ed. "I can't say that I blame you much—I don't like to see any unnecessary waste either. But you're up against a tough question when you try to stop spoilage. If you do it, you'll be the first to succeed."

"You're right—it gets me sore every time I see a good casting or forging thrown out on the scrap pile. I know I can't stop it entirely, but I think I can cut it down a lot."

"Well what's the big idea, Al?"

"Simply this—to make each man pay for his own spoilage; at least that part of it represented by his own time on the job. I guess the company will still have to stand for the material and labor on previous operations, but it will make a man think twice when he has to pay for his end of it."

"Do you think that's fair, Al? You're hiring a man for the use of his time, and you're supposed to know his capabilities. We'll assume the spoilage is not intentional or else you wouldn't have him around at any price. If it's accidental I don't see why it should come out of his pay."

"It's not intentional, Ed, and it's not entirely accidental. In 90 per cent of the cases, I figure it's downright carelessness. That's what I want to cure. It's been shown it can be done in the case of accidents—why not for spoiled work, too?"

"Because spoilage, Al, is a proprietor's risk, not a workman's."

"Why shouldn't it be the workman's risk, too? We look to him to turn out a certain quantity of work, and quality is at least as important. A spoiled job scores zero so far as quality is concerned."

"But, Al, you take spoilage into account when you consider a man for a raise in pay or when you lay him off. A lot of bad work is a blot on his record as a craftsman.

That should be penalty enough."

"Not directly enough to do much good, Ed, any more than a raise in pay is a substitute for a good premium plan. My method of docking him for carelessness should bring quick results."

"If a man puts in his time in good faith he should be paid for it. His wages are coming to him, spoilage or no spoilage."

"Oh, I'll pay him his base rate and take the spoilage loss out of any premium he may earn. He can't kick on that. As you say, he's hired for better or worse, so I'll just balance the worse against the better."

"And kill all incentive if a man spoils a job at the first of the week. No, Al, I think you'll lose more than you gain and just set up a possible cause of dissatisfaction among the workmen."

Is it fair to charge a workman for the time spent on a job that is spoiled? Will this practice cut down the percentage of spoiled work?

DISCUSSION

Weak Kneed?

We need plenty of real, intelligent cooperation throughout the mechanical industries. There is a shortage of this type of cooperation in most plants. Some plants hold conferences frequently and some of these develop into "windjamming" parties or possibly just plain lectures from the "old man." Conferences are necessary at times, but they do not always develop cooperation.

The fellow who willingly cooperates with others is not necessarily a "yes" man or a "weak sister," he may be a producer who can stand on his own feet. This type of man will assume responsibility and get out the work while his ability to work harmoniously with others, without loss of his own self-respect, benefit both the men under him and his employer.

Often foremen try to "make good" at the expense of fellow foremen in other departments. I knew a planer-room foreman who was a "hustler" and rushed all the work through in "slap-dash" style, adding to the work and worries of the fitters and erectors. If he had cooperated with the foreman of the erecting floor, the company would have profited and Mr. Planer Boss would still have his job. Now he is selling insurance while another man runs the planer department.

This second man is trying to plane work so well that it requires a minimum of scraping and fitting. This, of course, results in a slight increase in planing labor, but that increase is more than offset with better work and lowered labor costs in the erecting department.

Often you will find a "penny

pincher" who tried to make himself secure with the management by holding up foreman's requisitions for urgently needed tools. This fellow may think he is saving money for the company, but he is likely to create an expensive hold-up in the shop. Most foremen order only the items actually needed in their work, so a little co-operation will help the shop procure needed material and tools promptly. This, of course, will help make profits for the company.

—HERBERT M. DARLING

Loyalty—An Asset

There is a fundamental foundation of loyalty in every man. As applied to employer and employee relations, loyalty must be a 50-50 proposition. It is not logical to expect a blind, doglike faith on the part of the men if during slack times they are laid off without apparent consideration. There are difficult problems which confront both employer and employee in the establishment of mutual loyalty. That is the only kind that has any staying qualities.

Mutual loyalty calls for an interest on the part of the employee in the firm's success and a full appreciation that he and his fellow workers are as much "the company" as are the executives, the stockholders, the buildings and the equipment. He must have true pride in his job and in his own and his firm's accomplishments. Such loyalty calls for soundness of character on the part of both employer and employee. A cooperative interest on the part of both will make possible a "mutual success" of the business enterprise, both financially and socially.

The company, too, has its responsibilities. When business is good, these responsibilities are not quite so difficult to meet as when business is bad. During good times loyalty on the part of the firm means paying as high a wage as is possible in consideration of competitive and current industrial conditions. It also means the elimination of every possible health hazard and safety hazard in the plant, the making of a "day's work" for every employee as pleasant and helpful as is possible.

During bad times, the responsibility of providing work when, apparently, there are not orders to justify it, is added to the responsibilities listed above. This requires long-ranged planning of special projects on which men can be absorbed during slack periods. Such projects would include rearrangement programs, plant painting, maintenance work and the like. This, of course, requires the laying aside of sufficient funds during good times to meet these emergencies. Needless to say, government can do a great deal to help make it possible for industrial firms to take care of their employees when the "rainy day" comes.

Loyalty, to be of any true value, cannot be blind. It must be an intelligent, open-minded and open-eyed view based on mutual understanding and respect of the problems confronting both employer and employee. Loyalty is something that comes from pulling together towards a common goal; in making a cooperative attack on the problems confronting both.

—O. W. WINTER
Factory Manager
Columbus-McKinnon Chain Corp.
Chisholm-Moore Hoist Corp.

Real loyalty is something deeper than relations between employer and employee. Ed. is right, the relations should be on a business basis and strict impartiality should be the motto of all concerned. With steady work, fair wages and good conditions, the normal man will respond to the best of his ability.

Good working conditions are always appreciated and bring about better relations between all concerned. Men are more contented in a shop where working conditions are good, even though the pay may be slightly under that of some nearby locality. Congenial surroundings tend to improve and promote good will toward the employer.

—WM. W. BARNETSON

Where loyalty is lacking, it is often because of the absence of those things that inspire loyalty. Changes in industry during the last 30 or 40 years have affected the relationship between management and worker to such an extent that, except in a few cases, the personal touch that was possible in the small plant is lacking in the large.

In the old days, when nearly all concerns were privately owned and managed, both the workmen and the owner had struggled side by side, each feeling the pinch of bad times and the benefit of good times and there was a feeling of mutual regard for each other. In those days the boss knew the ability of every workman in the plant and treated each accordingly. Permanent employment, during the past ten years, has been hard to get and hard to hold, due to poor business or labor trouble. Lack of employee-employer cooperation has provided fertile ground in which the seeds of distrust and dissatisfaction can be sown.

—ARTHUR SILVESTER

Where There's Smoke

Permission to smoke during definite hours has the advantage that it permits regulation where prohibitive rules seemingly are not effective. Smoking while working has the disadvantage of increasing fire risk. Men should be permitted a few minutes in both the morning and the afternoon with the time regulated by the foreman so that not more than two or three men are out at the same time. Where the work is such that men have to wait for material, this waiting time could be allowed for smoking.

Conditions vary in all shops and smoking times would have to be regulated to meet these conditions. There should be no reduction in production and, since the men will be more contented there may be increased production records. Abuses of the smoking privilege could be regulated by withdrawing the privilege from any man found abusing it. Further, any employee found smoking anywhere but in the smoking room should be dismissed.

—W. E. WARNER
Sompting, Sussex, England

Smoking should be allowed in every plant, in so far as it is consistent with safety. There is no need to provide a special room in the ordinary plant; instead, the men should be permitted to smoke on the job and so keep production going. Where it is necessary to provide a smoking room, and thus break production, it will probably be necessary to have an extra supervisor to prevent too many workers being away from the job at the same time.

In two firms known to the writer, it was decided to allow a half an hour both morning and afternoon for smoking and also to permit smoking during overtime hours. It was not long before the men were smoking at other times. All smoking was then stopped as a punishment until a workers' committee persuaded the management to permit smoking at all hours of the day. This was tried and has proved a success. Where the whole shop, with non-smoker exceptions, would smoke for the allotted time when definite smoking periods were permitted, they find that no more than one man in ten is now smoking at any one time.

—W. A. HARRIS
Allesley, Coventry, England

IDEAS FROM PRACTICAL MEN

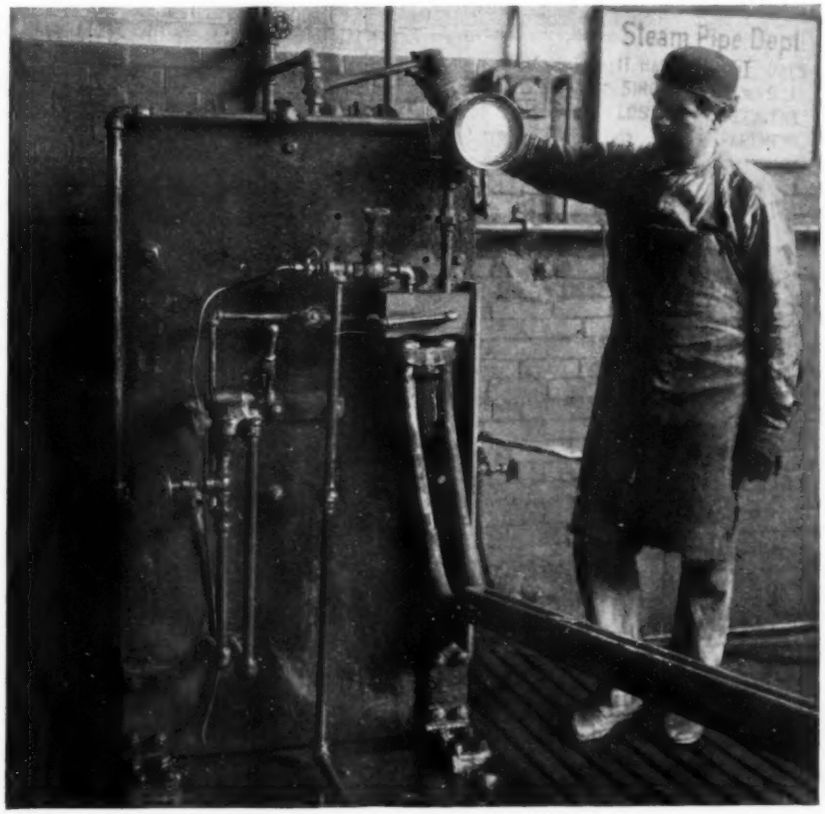
Superheater Coils Tested in Simple Apparatus

FRANK C. HUDSON

One of the problems of management is to balance the cost of special devices against labor cost, considering the percentage of time during which they will be used. In most railway shops, simple devices are most economical.

The use of superheaters in boilers has become standard practice on nearly all railroads, so that methods of testing the coils, or units, that go in the large flues are of general interest. Much ingenuity has been displayed in some large shops in the design and construction of testing devices that will handle a large number of coils at once. In few cases, however, do the number of superheater units to be tested warrant the expense of such devices.

The illustration shows a simple but efficient method of testing single superheater units. Even with multiple test racks each unit must be handled separately, coupled and released as a unit. The net saving of time by multiple testing is doubtful in most cases.

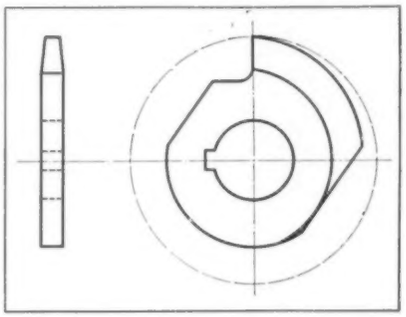


This method of testing superheater coils is in use at the Huntington shop, Chesapeake & Ohio Railway

Formed and Relieved Fly Cutter

MARTIN H. BALL

In milling jobs where the quantity is too small to warrant the expense of a standard formed and relieved cutter, the fly cutter illustrated will be found to be very efficient. Where there is reasonable assurance of the work being repeated at frequent intervals, it will pay to make a fly cutter of this type. While its cost will be slightly more than that of the ordinary fly cutter, it will be much less than that of the standard formed and relieved cutter, thus making a cutter that is the most desirable under the circumstances.



Where there is reasonable assurance of work in small quantities being repeated at frequent intervals, it will pay to make cutter of this type

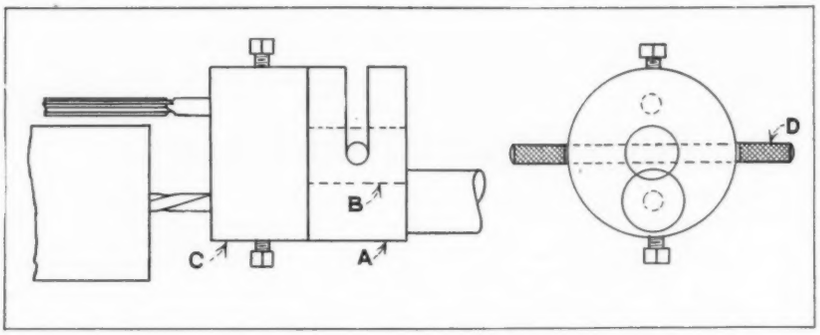
The cutter is made from flat stock, cut roughly to size and shape, bored, faced, keyseated, and then placed on an eccentric mandrel for forming and relieving the cutting face. Once made, the mandrel can be used for any future cutters of the same type that may be needed. The mandrel should be of the shoulder and nut type and provided with a key.

Increasing Turret Capacity

H. MOORE
Leeds, England

To get over the often encountered difficulty of having to use one more tool than the turret will hold, the auxiliary turret illustrated may be used where the size and shape of the work will permit.

The device consists of the body *A*, having a shank to fit the turret hole and bored at *B* to receive the shank of the auxiliary turret *C;* the index pin *D* fitting a slot in the body and engaging in a hole in the shank of the auxiliary turret; and the



The auxiliary turret holds two tools and can be indexed to bring either of them into cutting position while the other clears the work

necessary screws for holding the tools in place. It will be seen that the center distance of the holes for these tools is such that while one tool is cutting the other clears the work. As shown, a drill and a reamer are held in the auxiliary turret.

In operation, after the work has been drilled, the index pin is pulled out far enough to clear one side of the body and by it the auxiliary turret is turned 180 deg., thus bringing the reamer into cutting position while the drill clears the work. The index pin is then pushed back into the position shown, locking the auxiliary turret to the body of the device.

Riveting Fixture with Indexing Means

WILLIAM B. GREENER

The fixture illustrated was designed for riveting a bridge piece to the tube of an air cleaner in a high-speed hammer. The ends of the legs of the bridge piece are bent outward and engage holes previously pierced in the tube and project far enough for riveting.

The body of the fixture is a steel angle and the vertical leg is bored to receive the hardened and ground sleeve *A* which is held in place by the nut *B*. The stud *C* is a slip fit in the sleeve in which it is free to rotate. The lever *D* is pinned to the end of the stud and is used to turn it and the work in indexing. The steel ball *F* backed by a spring at *H* and alternately engaging dimples 180 deg. apart in the stud, comprises the indexing mechanism.

Two hardened and ground anvils *I* are fitted tightly into the stud and are slotted to receive the legs of the bridge piece. A pressure arrangement for holding the work in place while the riveting is being done consists of the hardened plug *K*; two slip fit plugs *L* and *M*; and the ball *N*; all backed by a spring at *O*. Screw *P* holds the fixture on the machine.

In operation, with the indexing mechanism out of position, the work is slipped into position on the fixture and is located by the legs of the bridge piece engaging slots in the anvils *I*. The lever *D* is turned until ball *F* engages one of the dimples in the stud, bringing the work into riveting position and bringing the pressure arrangement into action.

Since plug *K* and ball *N* are in the sleeve and plugs *L* and *M* and the spring at *O* are in the stud, when the stud is not of indexing position plugs *L* and *M* are bearing against the inner wall of the sleeve and no spring pressure is exerted on either plug *K* or ball *N*, and the work can be slipped in position on the fixture without interference. But when ball *F* is in one of the dimples of the stud, and plugs *K*, *L* and *M*; ball *N*; and spring *O* are in line the pressure of the spring is exerted on all the plugs and the ball and forces plug *K* and ball *N* against the inner wall of the tube and holds the work in position.

After riveting one leg of the bridge piece, a half turn of lever *D* brings ball *F* into the next dimple and the work is then in position for riveting the opposite leg of the bridge piece to the tube. This method of assembling air-cleaner parts on a high-speed riveting machine has resulted in considerable savings.

Small Drill Rods Stored Without Bending

C. F. FITZ

One of the greatest wastes of material in our shop used to be that of drill rods under $\frac{1}{8}$ in. in diameter. More rods of these small sizes were wasted than were actually used because of being bent in storage and handling. The fact that the smaller the size of the drill rods, the more they cost per pound is an item to be considered.

We have now eliminated nearly all of the waste by storing the rods in 2-in. iron pipes 37 in. long and capped at both ends instead of storing them in open racks as before. The pipes prevent injury to the rods when stored and make them easier to handle without bending. The size of the rods contained in each pipe is painted on the top of the cap.

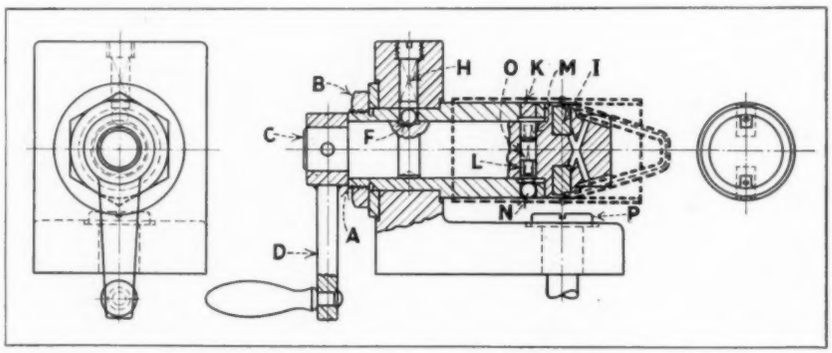
Progressive Dies Make Two Pieces Per Stroke

W. Z. FIDLER
Reynolds Engineering Company

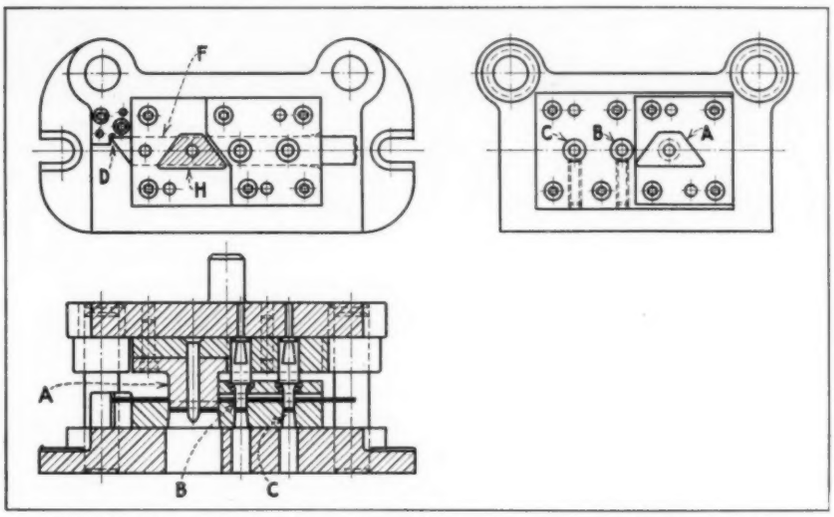
A variation of the typical progressive press tools for piercing and cutting off, whereby two blanks are produced at each stroke of the press, is illustrated herewith.

At the first station the end of the stock is trimmed at an angle by the punch *A* and two holes are pierced by the punches *B* and *C*. The stock is then advanced to the stop *D*, where punch *A* cuts off the blank *F* from the end of the stock and forces blank *H* through the die, blank *F* being left on top of the die. At the same time two holes are pierced in the stock behind the blanks just cut off. If the tools are used in an inclined press, blank *F* will slide off of the die to the rear, otherwise it can be removed by a jet of compressed air.

Tools of this type can be used for



Indexing is accomplished by a spring-actuated ball engaging dimples in the stud. The work is held in position by a ball and a plug



Two blanks are produced at each stroke of the press, one being cut from the end of the stock while the other is forced through the die

producing blanks having a variety of shapes so long as one of them is small enough to pass through the die-shoe.

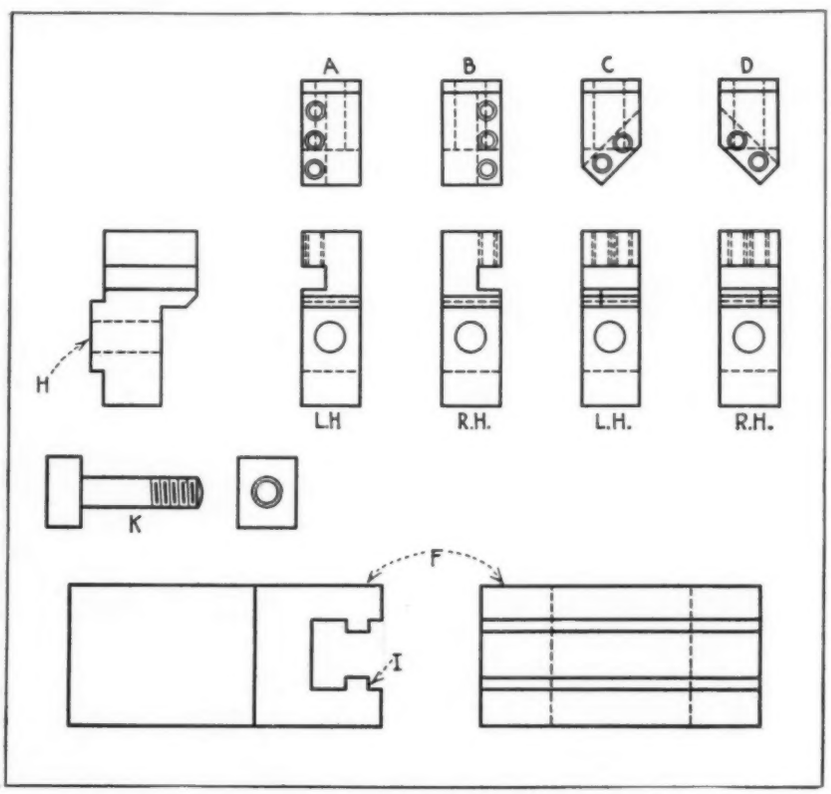
Adjustable Toolposts for a Gang Tool

GAYLORD G. THOMPSON

The toolposts illustrated at *A*, *B*, *C* and *D* are for a gang tool to be used in automatic and hand screw machines and lathes. The four toolposts are designed for use with high-speed steel toolbits. Each toolbit is positioned on the holder *F* by the shallow tongue *H* engaging the slot *I* and is held thereon by the bolt *K*, the head of which fits the T-slot.

The holder is clamped to the cross-slide toolblock, or if desired it may be provided with a round shank to fit the holes in the turret of the screw machine.

There are a number of positions in which the toolposts can be secured on the holder, so that the toolbits



The four toolposts can be so positioned on the holder that different diameters between shoulders on the work can be machined simultaneously

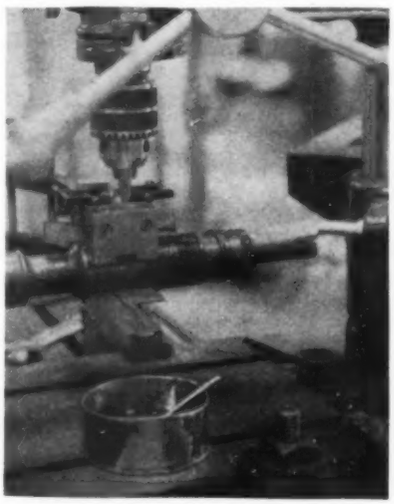
will machine work having several diameters and shoulders simultaneously. A set of these toolposts will save time in setting up.

Improvised Rig for End Milling

CHARLES WESLOW

The illustration shows how I rigged up for doing an end milling job in a horizontal milling machine that was not equipped with a vertical milling attachment.

A motor-driven bench drill was clamped to the table of the machine and the end mill was held in the

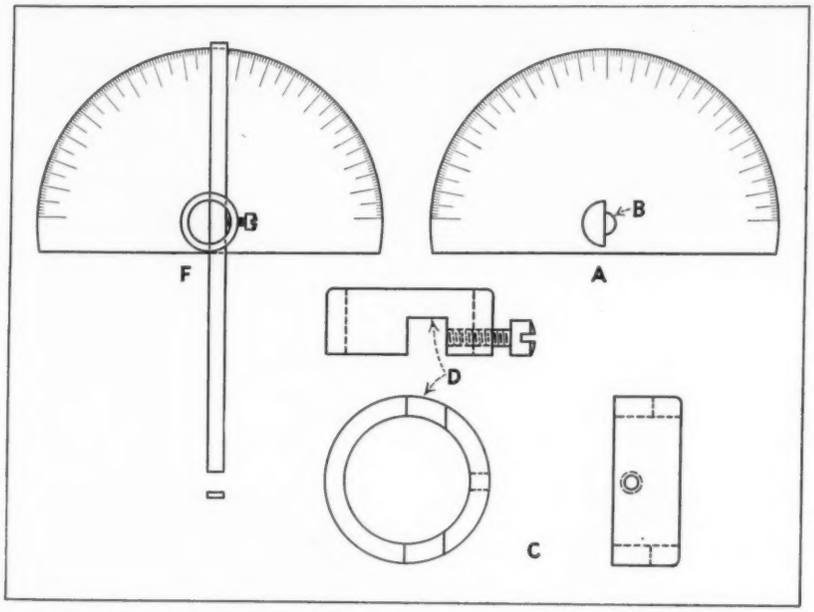


A motor-driven bench mounted on the machine table served as a vertical milling attachment. The work was held in a toolmakers' vise clamped between the arbor collars

chuck in its spindle. The drill press had to be shimmed up to bring its spindle square with the machine table.

The toolmakers' vise holding the work was clamped on top of the cutter arbor between the spacing collars. To prevent the arbor from springing, a piece of cold-rolled steel of the width of the vise was clamped between the same collars, but on the under side of the arbor. The back gears of the milling machine were locked in mesh, a piece of cardboard being placed between the teeth to prevent backlash.

Instead of raising the milling machine table for the cut, as would be done with a vertical milling attachment, it had to be lowered, carrying the drill press with it. Obviously, the milling machine spindle had to be locked in order to hold the work upright. This unusual example of machine-tool usage is typical of ingenuity required in job shops.



A blade attached to the stub by a collar and a machine screw made this protractor easy to read and has converted it into a more useful tool

Blade Attached to a Protractor

THEODORE KRUGER

The illustration shows how a blade can be attached to a protractor to make it easy to read and to furnish better means for scribing lines at required angles.

The protractor has a revolvably fitted stud at *B*, the head of which is cut away to the center so that a scale held against it will be guided by the flat.

For attaching a blade to the protractor, the collar *C* (shown enlarged) is bored to fit over the flatted head of the stud and is slotted at *D* for the insertion of the blade, which is held against the flat of the stud by the machine screw *D*, the assembly being shown at *F*. I have found my protractor fitted with this attachment to be very handy on many jobs and I believe that toolmakers will see its advantage.

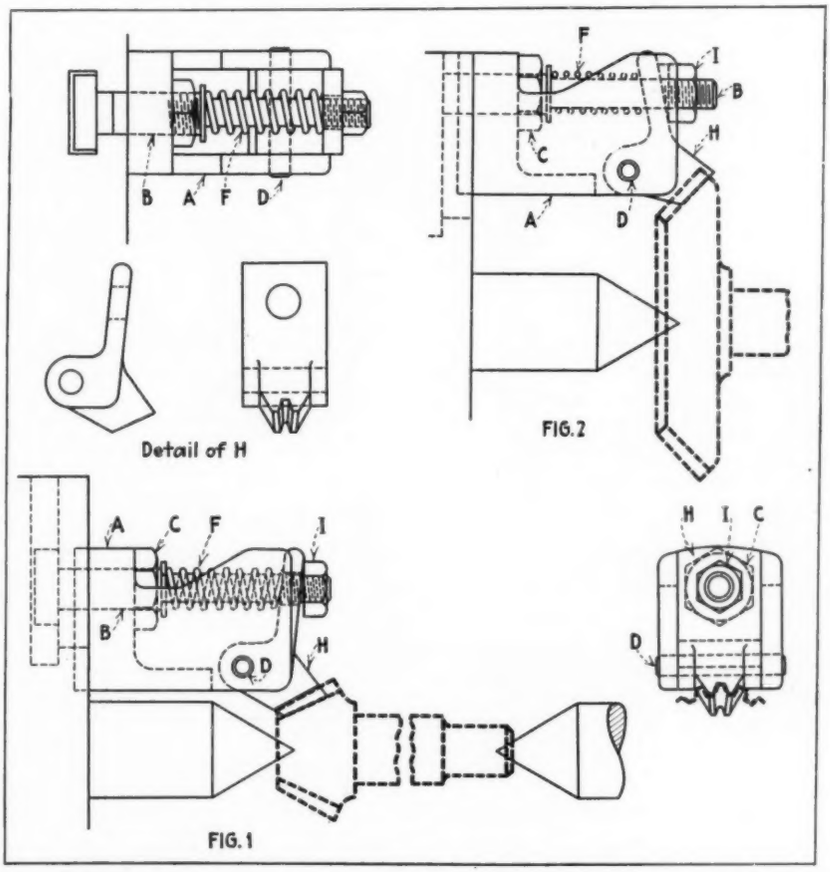
Dog for Driving Shafts Through Integral Gears

J. R. WHITTLES

In grinding shafts having integral bevel gears of different sizes at one end, the dog illustrated is used as a driver by engaging one gear tooth. The body *A* of the dog has a tongue fitting the narrow part of a radial T-slot in the faceplate of the grinder and is held in positon by the T-head bolt *B* and the nut *C*, making it adjustable for gears of different sizes.

Pivoted to the body at *D* and backed by the spring *F* is the driving finger *H* which is shaped to span one tooth of the gear. The driving finger is adjusted by the nut *I*, and after it has once been set for a particular gear it will automatically engage a tooth of other gears of the same size, pitch and face angle. Gears of different pitches require driving fingers shaped to fit their teeth.

In Fig. 1 the dog is shown in position for driving a shaft having a small integral bevel gear, while in Fig. 2 it is shown after it has been adjusted for a larger gear of the same pitch, but having a different face angle.



Shafts having integral bevel gears are driven for grinding by a pivoted finger shaped to engage one tooth. The dog is adjustable for different sizes of gears of the same pitch

Study the Chips

Distortion in hardening has long been a nightmare in the production of fine work. Some of this, according to careful study in large production plants, is caused by cold working of the metal during the cutting process. This may be because of dull tools or the use of improper cutting angles. If a tool leaves a smooth surface, be sure it is not caused by a burnishing rather than a cutting action.

One authority advocates a careful study of the chips as one way of checking the effect of the tools on the work surface. As with many factors in metal working, causes of defects may be in previous operations.

AMERICAN MACHINIST *Reference Book Sheet*

Allowances for 90-Deg. Bends in Sheet Steel

ALF J. ABRAHAMSEN
Chief Draftsman
Snead & Company

CONSIDERABLE time can be saved in laying out sheet metal parts with 90-deg. bends by employing the tables presented. Location of the bend lines will be found accurate (the tables have been used satisfactorily on several large contracts), and much tiresome arithmetical computation can be avoided.

Ordinarily the developed length of the blank is calculated by some such formula as length $L = A + B + 0.4\ t$ as published in the *American Machinists Handbook*. In this formula A and B are the inside dimensions of the legs of a 90-deg. bend and the $0.4\ t$ (t = metal thickness) represents the amount to be added for the bend itself.

Experience has shown, however, that the neutral plane of a formed metal part (for gages of No. 10-24, inclusive) lies 20 per cent of the thickness from the inside face and 80 per cent of the thickness from the outside face. Dash lines in Figs. 1 and 2 represent the neutral planes of square and reverse bends. Since the neutral plane is one where no stretching of the metal takes place, it is obvious that the length of the formed part along the neutral plane will be the correct length, or cutting size, of the sheet.

It is an easy matter to compute the distance of the neutral plane from either side of the sheet. Similar computations can be made for each gage in common use. Finally, deductions or allowances for square bends or reverse bends, either singly or together, can be computed and placed in tables for ready reference.

SQUARE BENDS. When the dimensions are given on the *outside* of a 90-deg. form, the bend is considered square. See Fig. 1.

REVERSE BENDS. When the dimensions are given on the *inside* of a 90-deg. form, the bend is considered reverse. See Fig. 2.

FOLDS. A fold, such as shown in Fig. 3, requires no deduction or allowance.

Sample Calculations

To show how the tables are computed, consider two square bends, Fig. 1, in 16-gage sheet. The lengths of the three sides along the neutral axes are:

$$\begin{aligned} 2 - 2\text{x}0.05 &= 1.90 \\ 1 - 0.05 &= 0.95 \\ 1 - 0.05 &= 0.95 \\ \hline & 3.80 \end{aligned}$$

Correct cutting length of the sheet is 3.80 in., not 4 in. The deduction to be made from the sum of the dimensions (which must all be on one side of the sheet) is 0.20 in. This amount checks with that given in the table, next page, for two square bends in 16-gage material.

Calculation of the cutting length for a part with reverse bends will show that material must be added to compensate for the bends. From Fig. 2 the lengths of the sides along the neutral plane are:

$$\begin{aligned} 2 + 2\text{x}0.0125 &= 2.0250 \\ 1 + 0.0125 &= 1.0125 \\ 1 + 0.0125 &= 1.0125 \\ \hline & 4.0500 \end{aligned}$$

The amount to be added to the dimensions of the piece in order to get the correct cutting length is 0.05 in. This value checks with the table for the allowance to be added when considering two reverse bends in 16-gage material. A blank layout, not to scale, is given for Figs. 1 and 2 to show the location of the bend lines.

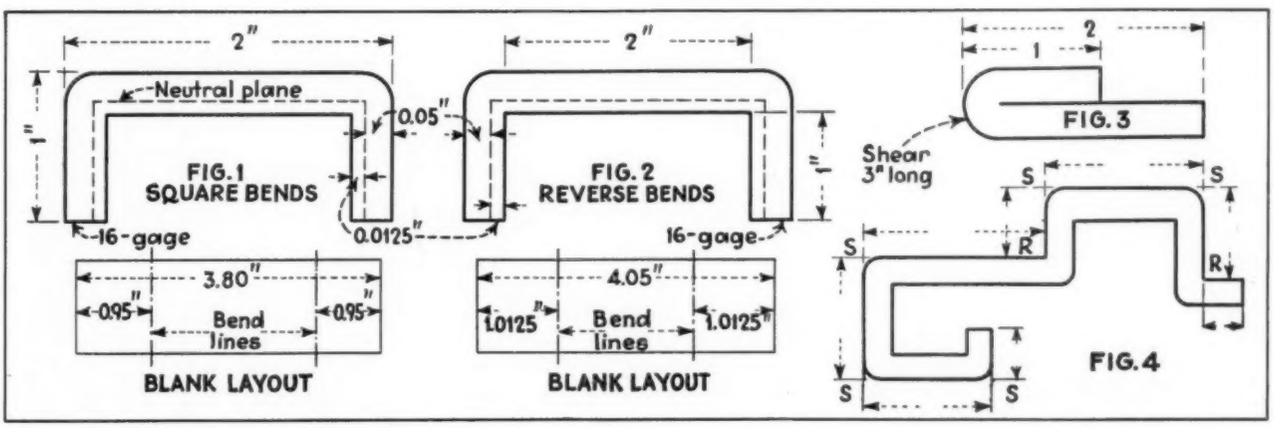
Other features of the table on the following page are a column of fractions and decimal equivalents and a column of the weights of sheet steel per sq.ft. in gages Nos. 10-24 inclusive.

Square and Reverse Bends

Tables of deductions or allowances for combinations of square and reverse bends, Fig. 4, will be published in an early number. These tables are also based on gages Nos. 10-24 inclusive. They are set up to give the answer directly for combinations of from one square bend and one reverse bend to eight square bends and six reverse bends, thus taking in practically every case that will come up. In addition, values are given for the condition of no square bend and one reverse bend, and vice versa. The zeros in the headings indicate the absence of one or the other kind of bend.

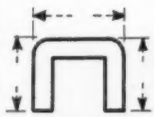
In the third horizontal row of figures in the headings, one will see a tabulation of constants. These can be used to find the allowance or deduction when the gage is not U.S.S. The actual thickness of the metal is multiplied by the constant to get the figure directly.

The figures given in the tables to be published shortly are actually the algebraic sum of the allowances or deductions for the individual bends. In some cases the result is positive and is indicated by a plus sign, meaning that this amount must be added to the dimensions on the piece. Where no plus sign is given, the figure must be deducted from the sum of the dimensions.



AMERICAN MACHINIST *Reference Book Sheet*

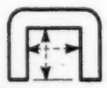
Allowances for 90-Deg. Bends in Sheet Steel



Square Bends

TO DETERMINE CUTTING SIZE OF SHEET STEEL

Add all the dimensions which must be on one side of sheet. Then deduct for square bends or add for reverse bends the dimension in the table which corresponds to the number of bends



Reverse Bends

U.S.S. GAGE		DEDUCT FOR SQUARE BENDS										LOCATION OF BEND LINE	
NO.	EQUIV.	1 BEND	2	3	4	5	6	7	8	9	10	0.2t	0.8t
24	0.025	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.005	0.02
22	0.03125	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.00625	0.025
20	0.0375	0.06	0.12	0.18	0.24	0.30	0.36	0.42	0.48	0.54	0.60	0.0075	0.03
18	0.05	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.01	0.04
16	0.0625	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	0.0125	0.05
14	0.0781	0.125	0.25	0.375	0.50	0.625	0.75	0.875	1.00	1.125	1.25	0.0156	0.0625
13	0.09375	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	0.01875	0.075
12	0.1094	0.175	0.35	0.525	0.70	0.875	1.05	1.225	1.40	1.575	1.75	0.0219	0.0875
11	0.125	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00	0.025	0.10
10	0.1406	0.225	0.45	0.675	0.90	1.125	1.35	1.575	1.80	2.025	2.25	0.0281	0.1125

U.S.S GAGE		ADD FOR REVERSE BENDS										WEIGHT PER SQ. FT.
NO.	EQUIV.	1 BEND	2	3	4	5	6	7	8	9	10	480 LB. = 1 CU. FT.
24	0.025	0.010	0.020	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	1.00 lb.
22	0.03125	0.0125	0.025	0.0375	0.05	0.0625	0.075	0.0875	0.10	0.1125	0.125	1.25
20	0.0375	0.015	0.03	0.045	0.06	0.075	0.09	0.105	0.12	0.135	0.15	1.50
18	0.05	0.020	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	2.00
16	0.0625	0.025	0.05	0.075	0.10	0.125	0.150	0.175	0.20	0.225	0.25	2.50
14	0.0781	0.03125	0.0625	0.09375	0.125	0.156	0.187	0.218	0.25	0.281	0.312	3.125
13	0.09375	0.0375	0.075	0.1125	0.15	0.1875	0.225	0.262	0.30	0.337	0.375	3.75
12	0.1094	0.04375	0.0875	0.1312	0.175	0.2185	0.262	0.306	0.35	0.394	0.4375	4.375
11	0.125	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	5.00
10	0.1406	0.05625	0.1125	0.1687	0.225	0.281	0.3375	0.394	0.45	0.506	0.562	5.625

FRACTIONS AND DECIMAL EQUIVALENTS	
1/64	0.0156
1/32	0.0313
3/64	0.0469
1/16	0.0625
5/64	0.0781
3/32	0.0938
7/64	0.1094
1/8	0.125
9/64	0.1406
5/32	0.1563
11/64	0.1718
3/16	0.1875
13/64	0.2031
7/32	0.2188
15/64	0.2344
1/4	0.25
9/32	0.2813
5/16	0.3125
11/32	0.3438
3/8	0.375
13/32	0.4063
7/16	0.4375
15/32	0.4688
1/2	0.50
17/32	0.5313
9/16	0.5625
19/32	0.5938
5/8	0.625
21/32	0.6563
11/16	0.6875
23/32	0.7188
3/4	0.75
25/32	0.7813
13/16	0.8125
27/32	0.8438
7/8	0.875
29/32	0.9063
15/16	0.9375
31/32	0.9688
1"	1.00

NEWS OF THE INDUSTRY

"Industrial Review" Grows to "Gaging Business"

That short authentic report of conditions in the principal machine-tool markets, the "Industrial Review," which heretofore has appeared on this page, has been broadened in scope and expanded into a full-page feature, "Gaging Business." Look for it on page 1*b*.

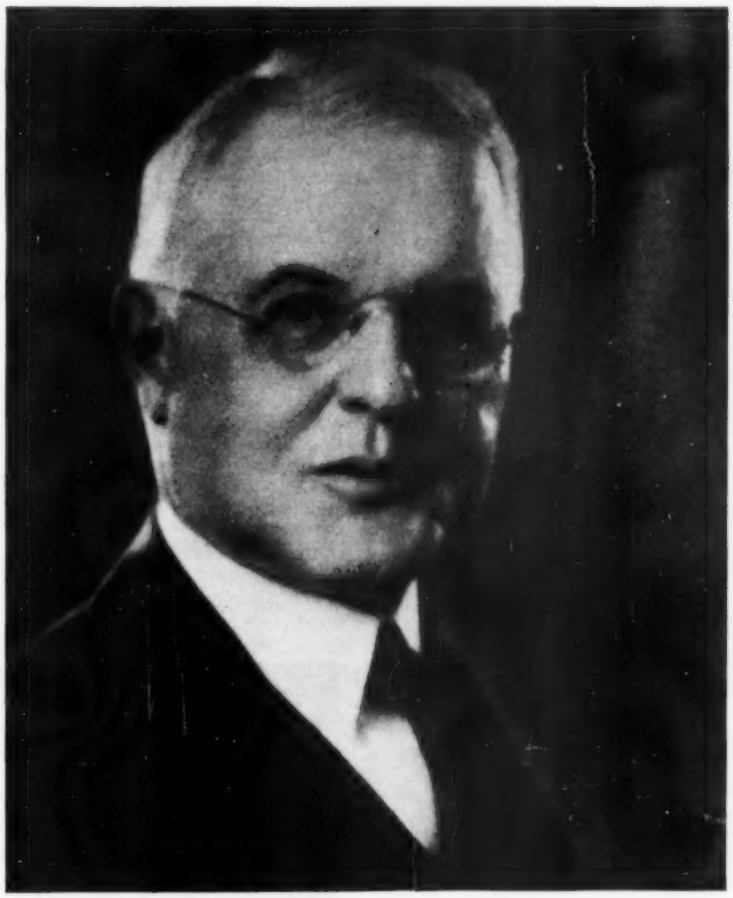
The Industrial Review served well in giving an up-to-the-minute report on machine-tool selling conditions in the metal-working areas from Boston to San Francisco. It reflected accurately the viewpoints of industrial managements throughout the country, as gaged by their willingness to spend money for new equipment. This service will continue as a part of Gaging Business.

Additional facts regarding current conditions and trends in all important metal-working industries now are being obtained from sources intimately connected with those industries. Trained editorial observers in key centers from coast to coast are contributing data. The whole mass of figures and expert opinion will be digested in a single page that gives a complete composite picture of the status of the metal-working industry.

Volume 82

In November of last year *American Machinist* rounded out sixty years of service to the metal-working industry. In Volume 82, of which this is the first number, the editors and publishers pledge a continuation of this service and an improvement of it wherever there is a chance to do so. Started in 1877 by Horace B. Miller, with Jackson Bailey as its first editor, it has been edited successively by Frank F. Hemenway, Fred J. Miller, Frederick A. Halsey, Leon P. Alford, John Van Deventer and Ethan Viall.

The new volume will be edited by the following staff: Fred H. Colvin, editor emeritus; Kenneth H. Condit and Burnham Finney, editors; John Haydock, managing editor; S. Ashton Hand, associate editor; H. R. Le Grand and Ben C. Brosheer, assistant editors; Raymond R. Wiese, western editor, Chicago; Athel Denham, Detroit; Paul Wooton, Washington; H. S. Knowlton, Boston; Wayne Snowden, San Francisco; Charles F. McReynolds, Los Angeles; Frank Rising, labor editor; C. G. Smith, art director.



JAMES E. GLEASON
President, Gleason Works

To Be Honored—**At the annual meeting of the Society of the Genesee next week Mr. Gleason will be the recipient of an award for distinguished achievement**

Gear Makers to Meet

The American Gear Manufacturers Association will hold its 22nd annual meeting at the General Brock Hotel, Niagara Falls, Canada, April 18-20. The program will be announced later, according to J. C. McQuiston, manager-secretary, who is located at the Penn-Lincoln Hotel, Wilkinsburg, Pa.

DETROIT LETTER

Detroit recovering from jitters after collapse of car production . . . Hudson in limelight with its 112 . . . Ford begins to place equipment orders . . . Industry is studying design and price changes

DETROIT—The gag around Detroit has been, "At last the automotive industry has adopted the 'closed shop' principle." Rather old, but never so true as now. Chrysler closed all plants before Christmas and had not reopened any of them at the time this was written. General Motors announced the layoff of 30,000 more men (30,000 had already been laid off since October). Ford drastically cut employment in all departments except assembly lines, body and sheet metal. Even Graham, way behind on orders a few weeks ago, had to shut down January 5 for 10 days.

The sudden collapse in production has had no parallel in automotive history. Retail sales dropped 15 per cent in November and better than 30 per cent in December, compared with a year ago. Everybody cancelled orders and held up commitments. It was a swell way to start a New Year. Instead of waking up January 1 with a headache, Detroit had the headache on New Year's Eve, and just hung on to it.

Worst Is Over

It still has its headache, but signs indicate that the worst is over. Steel releases have started trickling through, car sales have stopped declining and are sideways. Hudson has announced that 6,000 men will return to work within the next few weeks to speed up assemblies on the new Hudson 112, a lower-priced economy car.

William S. Knudsen, testifying in Washington, asserted that General Motors would equip five new plants this year. On top of these favorable developments, Ford is understood to have released the first of huge pending orders for equipment. Chrysler has called a meeting of its entire executive organization for January 11 and will probably get back into production right after that.

Hudson's new car may easily be the forerunner of similar moves by other companies if it meets with a favorable public reception. It consists of a Hudson-Terraplane body shell with less expensive trim and upholstery, Terraplane chassis units with the exception of a shorter frame, a five inch shorter wheelbase (most of which came out of the front end), the Hudson six engine with most parts the same except for a shorter stroke crankshaft, and a price about $100 under the former lowest-priced model in the Hudson line. At that the car is still priced above Ford and Chevrolet standard models.

Hudson has announced it would spend $11,000,000 additional for equipment, tools and materials. This figure, however, includes production materials for car assemblies. Just how much the company intends to put into 1939 tooling was not revealed.

Mr. Knudsen's "five-plant" statement assumed to refer to Harrison Radiator in Lockport, Delco Appliance in Rochester, Ternsted in Trenton, Inland Mfg. in Cranford, N. J., and Sunlight Electric in Warren. These plants, with the exception of Sunlight, are in various stages of completion. It is understood no contracts have yet been let for Sunlight.

Ford is believed to have placed orders with press manufacturers for equipment for the new stamping plant at Rouge, which will not be finished for another year. Ford has also ordered a large butt-welder for welding large sheets into continuous rolls of 12,000 to 14,000 lb. each. This operation will take place following the pickling of sheets and will duplicate equipment now found at such plants as Inland Steel and Great Lakes Steel.

Since K. T. Keller officially denied the coming of new models or lowering of prices at Chrysler, it would hardly be reasonable to suppose that the January 11 meeting would have anything to do with such subjects. Nevertheless, reports persist that Plymouth will undergo a little plastic surgery and be provided with a new nose, in addition to new chrome trim strips which will "doll up" the outside of the bodies

Quicker Case—Packard Motor Car Co. has installed a battery of eight Tocco induction casehardening machines for its camshafts. The bottom cam on the vertically placed camshaft is induction heated for 4.7 sec. and quenched by water streams. Shaft lowered for next cam. Eight shafts hardened in 7½ min.

Motor Industry Has Second Best Year

The 1937 output of American automobile companies is estimated at 4,975,000 units, exceeded only by the 1929 output of 5,621,715 cars and trucks. Last year's output was 8 per cent ahead of 1936 and 250 per cent ahead of 1932. Figures given below are abstracted from "Preliminary Facts and Figures of the Automobile Industry Calendar Year 1937" by Alfred Reeves, vice-president of the Automobile Manufacturers Association.

Production and Value	
Car and truck factory sales, U. S. and Canada	4,975,000
Passenger cars	4,050,000
Motor trucks	925,000
Percentage increase over 1936	8
Wholesale value of cars, U. S. and Canada	$2,270,000,000
Wholesale value of trucks, U. S. and Canada	532,000,000
Wholesale value of parts and accessories for replacement, and service equipment	1,075,000,000
Motor vehicles, accessories, service equipment and replacements of parts and tires	4,177,000,000
Registration	
Motor vehicles registered in U. S.	29,650,000
Motor cars	25,400,000
Motor trucks	4,250,000
Per cent of world's automobiles in U. S.	70
Taxes	
Total motor vehicle user taxes	$1,580,000,000
Gasoline taxes, federal, state and municipal	960,000,000
Percentage motor user taxes to all taxes from all sources, federal, state and local	15
Employment	
Employment, in auto, auto body & parts factories	517,000
Weekly payroll, wages	$15,500,000

after the cars begin to roll off the assembly line once more. Ford is said to be playing with the idea of "fixing up" the "60". It won't be surprising to see this line coming through shortly with the same front ends as on the de luxe models. This would involve little change, since the hood and grille stampings on the two Ford lines are virtually interchangeable as to fit.

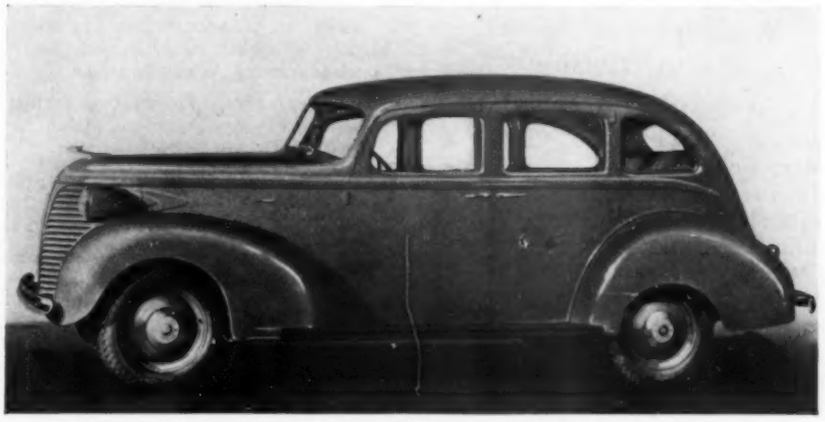
Ford is turning out 4000 cars daily, but this rate is not reflected in activities at the Rouge plant, except in the sheet metal department, because of huge inventories of chassis units and engines. These are being gradually fed back into production and by January 15 will be down to a level comparable to that of body parts. Thus Ford should expand manufacture shortly and materials releases will be larger. At a rate of 4000 cars a day Ford mills are able to supply sheets for 50 to 60 per cent of the company's output. Inventories accumulated during October and November account for an additional appreciable percentage of steel which does not have to be ordered outside.

What to do about car prices is a moot question. Since the industry cannot make money at present sales levels, lower prices without bigger sales wouldn't help. Automotive executives frankly admit that even a $5-a-ton cut in steel wouldn't mean anything, so far as aiding car sales is concerned. It all comes back to the question of getting the public started buying cars again.

The poor sales prospects has raised the question of when to bring out new models. Factories are trying to decide whether to aim for another fall show or return to January announcements. Dealers favor the latter course. If the final vote is for January, tooling programs would be shifted back at least two months. Instead of releases coming through in February (which was the plan a month ago), orders would be delayed until after March 15.

The industry knows that it eventually must offer cars which deliver for less than do present models. Willys' successful year in 1937 proved that point. It's just a question of when.

Harry T. Woolson (left), president of the Society of Automotive Engineers, and executive engineer, Chrysler Corp., will pass the gavel to C. W. Spicer (right), president-elect of the S.A.E., and vice-president, Spicer Mfg. Corp., at annual meeting in Detroit, Jan. 10-14



In Lowest-Priced Field—**Hudson's "112" has an 83-hp. motor and a hood hinged at the front**

JAMES M. MOONEY

J. D. Mooney Will Speak at Engineering Council

James D. Mooney, president of the General Motors Export Co., will be the dinner speaker before the American Engineering Council on Jan. 13 at the Mayflower Hotel, Washington, D. C. Andrey A. Potter, president of the A.E.C., and director of the schools of engineering, Purdue University, will preside as toastmaster.

Discussion of current problems will center about the engineer's economic status, evalution of technology, engineering economics in public and private enterprise, and similar subjects. It is hoped that the official representatives of 50 engineering organizations will reduce engineering opinion to resolutions designed to make engineers and their organizations more effective in the public interest. Election of officers will take place on the last day of the annual meeting, which is set for Jan. 13-15.

Westinghouse Moves Radio Division

Water E. Evans, manager of the radio division, Westinghouse Electric & Mfg. Co., has announced that the division will be moved from Chicopee Falls, Mass., to a modern manufacturing plant at Wilkens Ave. & Catherine St., Baltimore. Transfer of employees and equipment will be completed within the next six months. Other equipment now manufactured at Chicopee Falls, such as soft-drink dispensing cabinets, will continue to be produced in the Springfield area.

Heating Show Starts Jan. 24 in New York

More than 300 companies have taken space at the Fifth International Heating & Ventilating Exposition which opens at the Grand Central Palace, New York, on Jan. 24 and runs until Jan. 28. The exposition is sponsored by the American Society of Heating & Ventilating Engineers, and is to be held in conjunction with the annual meeting at the Hotel Biltmore.

Among exhibits will be oil burners, gas-fired and coal-fired units and many examples of automatic heating equipment. Numerous displays will show the trend toward year-around air conditioning. Accessory devices such as humidifiers, filters, water heaters, temperature and humidity controls will embody the latest design features. More than 80 items of tools and plant equipment used in fabrication of sheet metal may be viewed including new corner-lock forming units and hand-operated flangers.

Foundry Equipment Makers Set Annual Meeting Date

Arthur J. Tuscany, executive secretary and treasurer, Foundry Equipment Manufacturers Association, has announced that the organization's annual meeting will be held at the Cleveland Hotel, Cleveland, on Feb. 8. Three directors will be elected to fill expiring terms, and further consideration will be given to broadening credit interchange work and to developing an industry directory of companies in the foundry business.

MEETINGS

AMERICAN ENGINEERING COUNCIL. Eighteenth annual assembly, Jan. 13-15. Hotel Mayflower, Washington, D. C.

AMERICAN MANAGEMENT ASSOCIATION. Eighth packaging exposition, March 22-25, Palmer House, Chicago.

AUTOMOTIVE ACCESSORY MFRS. ASSOC. Eleventh annual exposition, Feb. 28-Mar. 1. Port Authority Bldg., New York.

INTERNATIONAL AIR SHOW. Exhibit of equipment and supplies, Jan. 28-Feb. 6. International Amphitheatre, Chicago.

INTERNATIONAL HEATING & VENTILATING EXPOSITION. Jan. 24-28. Grand Central Palace, New York.

NATIONAL RAILWAY APPLIANCES ASSOCIATION. March 14-17. Chicago.

Underwood & Underwood

FRED G. WACKER

Fred G. Wacker Heads Motor Equipment Mfrs.

At a meeting of the board of directors, Motor and Equipment Manufacturers Association on Jan. 11 the following officers were elected for the current year: president—Fred G. Wacker, president, Automotive Maintenance Machinery Co.; vice-president—Herbert L. Sharlock, vice-president, Bendix Aviation Corp.; secretary—W. P. Ferris, sales manager, Blackhawk Manufacturing Co., and treasurer—Clyde Park Brewster, sales manager, K-D Manufacturing Co.

Electrical Engineers Will Discuss Welding

The American Institute of Electrical Engineers will hold its winter convention from Jan. 24-28 at the Engineering Societies Bldg., New York. Sixteen technical sessions are scheduled, one of which, electric welding, is on the program for 2 p.m., Jan. 26. The four papers are: "Recent Advances in Resistance Welding" by the resistance welding subcommittee; "Mechanical High-Speed Resistance Welder Control" by F. H. Roby of the Square D Co.; "Interpretation of Oscillograms of Arc Welding Generators in Terms of Welding Performance" by K. L. Hansen of the Harnischfeger Corp.; and "The Rating of Resistance Welding Transformers" by C. E. Heitman of the Edward G. Budd Mfg. Co. Presentation of the Edison Medal to Gano Dunn will be made during the evening of Jan. 26. Sight-seeing trips have been arranged.

WATCHING WASHINGTON

President is more conciliatory than his lieutenants . . . Cummings favors licensing proposals . . . Relief and Navy spending may bulge budget . . . Court vacancy likely to be filled by ardent New Dealer . . . Census reveals 10,000,000 unemployed

WASHINGTON—Congress and the country are confused by the apparent contradictions of New Deal spokesmen. Assistant Attorney General Jackson and Secretary Ickes lashed out against "aristocratic anarchy" in tones that left the nation awaiting a climax in the President's message to Congress. Continuation of the Jackson-Ickes chastisement was not in the cards, however; the President's speech was conciliatory and was followed shortly afterwards by a suggestion that industry sit down with the government for the purpose of economic planning. Thus appeared the possibility, on one hand, of a government controlled industry, having all the earmarks of monopoly, and on the other hand, a reversion to greater competition with emphasis on small business units.

Licensing Favored

One development in the crusade against monopoly is seen in the friendly attitude of Attorney General Cummings toward the federal licensing measures introduced by Senator O'Mahoney, of Wyoming, and Borah, of Idaho, now pending before a senate committee. The ill-will President Roosevelt is known to feel towards big business makes it easy for him to transfer his objective to control of price fixing. There are, at least, three other arguments in favor of such a program. One is the hope that the administration's five-year old wish to meet the monopoly problem now be undertaken, a desire made more intense by New Deal spokesmen who allege the recession was partly caused by monopolistic price setting. Another reason was that such a campaign would be peculiarly appropriate in view of the wage-hour bill collapse, and lastly, that it will enable the President to move leftwards so fast "that no depression can catch up with him," as one of his advisers is quoted as saying. In his Jackson Day address the President emphasized that his feud was with "a mere handful" of bankers and industrialists—not with business men in general.

While the 1939 budget submitted to Congress last Wednesday showed a deficit of $949,600,000 it is obvious that it will be much greater. The budget provides only $1,000,000,000 for work relief, and this item is sure to be increased. It is also believed that Congress will boost the highway allotment of $140,000,000 as carried in the budget. The President will submit supplemental estimates for naval construction as he warned Congress to be prepared for a request for an unnamed additional sum to increase the navy fleet. If he follows Navy Department recommendations, he will ask for 37 to 39 ships covering all catagories and aggregating 237,000 tons beyond the Vinson-Trammell limits.

Outside of the fact that the country faces another year of deficit financing, the most imortant feature of the 1939 budget is the recommendation that the President be given the veto power over individual items in the appropriation bills. That 38 states have adopted this plan, which is operating to prevent the covering of questionable items in omnibus bills, has lead to a demand for the same procedure by the federal government. Extension of this policy to the federal government is complicated by the fact that it may require a Constitutional amendment.

Sutherland's Successor

One more barrier to New Deal policies was removed with the resignation of Associate Justice George Sutherland, conservative member of the Supreme Court. Justice Sutherland did not give the reason for his resignation other than the fact that he had passed his 75th birthday and wished to take advantage of the privileges of the retirement act enacted last year. Representative Hatton W. Sumners, chairman of the House Judiciary Committee, is backed by that committee to fill the court vacancy. In view of Sumners' opposition to the President's court reorganization plan, the selection of another aspirant is more than likely.

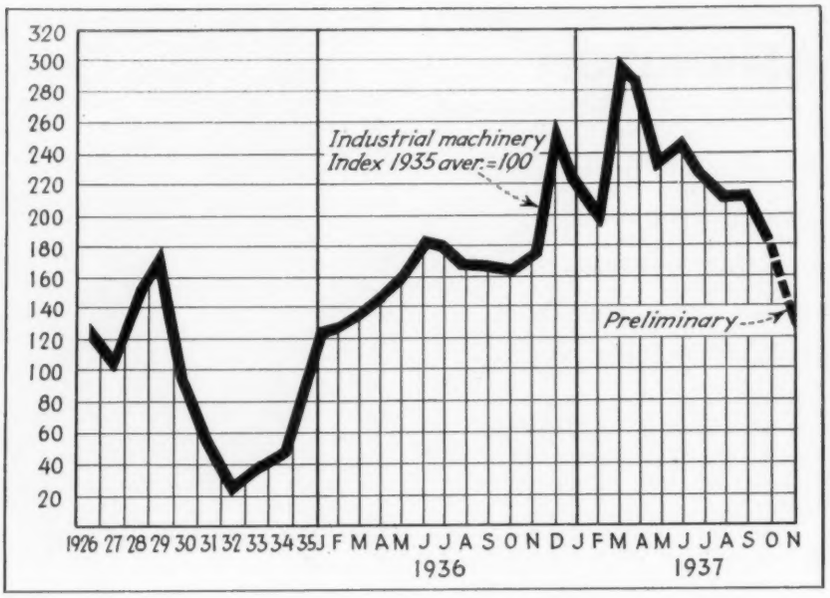
Announcement of the figures on unemployment by John D. Biggers, director of the census, provided more actual data upon which to build a program of reemployment than the Works Progress Administration has made public in five years. The card count made November 16 to 20 resulted in the voluntary registration of 7,822,912 persons as unemployed. A door-to-door check showed a 72 per cent response to the original distribution of blanks, which would indicate a total unemployment at that date of approximately 10,870,000. In addition to the over-all figures, the census gave an accurate idea of the age groups in which unemployment is the greatest. It also revealed the industries that could be expected to absorb the greatest number of unemployed if they were stimulated.

MANAGED MONOPOLY

Planned economy, in the Roosevelt sense, is on the agenda. It is to come if Roosevelt can force it. His idea of it is for the manufacturers of any given industry to get around a table with government experts, figure out the probable demand for their commodities, and then divide up the business! With one little reservation—there must be no forced sales, no false stimulation of business by deceptive advertising. In fact, if one judges by his illustrations, the railroads buying rails early last year and the folks of Hyde Park buying automobiles ahead of schedule, each expecting a price rise, there is a question about any advertising appeal, even if it happens, as it was in these instances, to be absolutely true!

Retired manufacturers in Congress are aghast at the idea. So are the trust and monopoly baiting New Dealers. So are the folks who thought NRA bred monopoly. None of them think it would work very long. But Roosevelt does, and furthermore Roosevelt never believed that story about NRA breeding monopoly. He thinks it was put out by economic royalists to fool the plain people.

Actually, all the complaint of Administration spokesmen, from Robert H. Jackson down to Harold Ickes, and from Ben Cohen and Tom Corcoran up to Robert M. La Follette, is NOT against monopoly, but against prices they think too high, maintained by conspiracies in restraint of trade.—Carter Field, McGraw-Hill Washington Bureau.



Machinery Index Down

At a level of 132.5, a preliminary figure with one factor missing, the American Machinist Index of Industrial Machinery Orders in November dropped closer to the 1935 base level of 100. From present indications no appreciable improvement should be expected for some weeks.

Exports of Machinery During November, 1937

	November 1937	October 1937	November 1936
Electrical machinery and apparatus	$9,172,619	$10,260,459	$7,630,837
Power generating machinery except automotive and electric	1,396,852	1,533,364	683,012
Construction and conveying machinery	1,911,374	2,349,050	711,689
Mining, well and pumping machinery	4,432,411	5,619,140	2,859,878
Power driven, metal-working machinery	5,988,511	5,647,238	3,785,013
Other metal-working machinery	364,664	348,697	250,373
Textile machinery	962,465	1,291,253	773,359

Exports of Metal-Working Machinery During November, 1937

	November 1937	October 1937	November 1936
Engine lathes	$474,283	$392,572	$163,545
Turret lathes	449,716	321,421	165,383
Other lathes	63,227	159,030	113,970
Vertical boring mills and chucking machines	142,492	149,617	167,253
Thread cutting and automatic screw machines	336,318	359,619	198,512
Knee and column type milling machines	478,697	332,049	118,212
Other milling machines	460,955	416,086	222,207
Gear cutting machines	164,623	244,997	96,275
Vertical drilling machines	41,677	41,975	106,768
Radial drilling machines	70,561	13,146	67,909
Other drilling machines	204,903	132,463	175,185
Planers and shapers	160,210	77,277	25,677
Surface grinding machines	175,391	155,488	97,639
External cylindrical grinding machines	151,707	154,324	73,555
Internal grinding machines	190,168	405,375	270,806
Tool grinding, cutter grinding and universal grinding machines	152,586	186,559	218,112
Other metal grinding machines	229,789	132,413	112,142
Sheet and plate metal grinding machines	373,565	275,686	410,930
Forging machinery	102,485	269,696	174,388
Rolling mill machinery	801,585	486,006	236,763
Foundry and molding equipment	131,765	171,756	62,389
Other power-driven metal-working machinery and parts	631,808	769,583	507,393

Other Metal-Working Machinery

Pneumatic portable tools	$124,609	$109,928	$67,858
Portable and hand and foot operated metal-working machines and parts	104,690	108,426	58,602
Chucks for machine tools	27,255	16,531	21,530
Milling cutters, machine operated threading dies and taps and similar machine operated metal cutting tools	59,041	42,938	52,180
Other metal-working machine tools	49,069	70,874	50,203

A.S.M.E. Spring Meeting at Los Angeles, March 23–25

First of four national meetings to be undertaken per year by the American Society of Mechanical Engineers will be held at the Hotel Biltmore, Los Angeles, March 23-25. Twelve technical sessions will be devoted to hydraulics, fuels, aeronautics, management, applied mechanics, petroleum. The A.S.M.E., the American Society for Metals and the American Welding Society are among several groups sponsoring a Western Metals Congress, Los Angeles, week of March 21.

PERSONALS

J. HALSEY MCKOWN, of Pittsburgh, was appointed Jan. 1 as assistant vice-president of the United States Steel Corp. of Delaware, under C. V. MCKAIG, vice-president in charge of sales.

DAVID F. AUSTIN, manager of sales, Chicago District, Carnegie-Illinois Steel Corp., succeeds Mr. McKaig as vice-president in charges of sales.

THOMAS J. HILLIARD, is now general manager of sales, Carnegie-Illinois, succeeding Mr. McKown.

PHILIP M. GUBA is now manager of sales, Chicago district, succeeding Mr. Austin.

FRANCIS C. HARDIE is now manager of sales, Detroit District, succeeding Mr. Guba.

THOMAS J. BRAY, JR., is now manager of sales, Pittsburgh District, succeeding Mr. Hilliard.

F. ROYAL GAMMON is now manager of sales, Cleveland District, succeeding Mr. Hardie.

RAYMOND L. LANSING, general manager of the Eclipse Aviation Corp., a subsidiary of the Bendix Aviation Corp., has been appointed general manager of the New Jersey division of the parent company. BENJAMIN GILPIN was appointed works manager.

RAYMOND W. RUDDON has been elected president of the Federal Truck Co., succeeding M. L. PULCHER, resigned. Mr. Ruddon had been vice-president and general manager.

ROLLIN B. PLUMB has been elected vice-president of the Eagle Lock Co., Terryville, Conn., and will be in charge of production.

LESLIE HOFFMAN has been made works manager of the J. L. Lucas & Son, Inc., Bridgeport, rebuilders of machine tools.

WILLIAM C. CONNELLY, who was president of D. Connelly Boiler Works, Cleveland, at the time it was taken over in 1931 by Foster Wheeler Corp., has been elected president of the Ohio Seamless Tube Co., to succeed EDWIN MANSFIELD, who is now chairman of the board.

ROYAL M. BATES has been elected president of the Jamestown Metal Corp.

WALTER E. HADLEY

E. E. MOORE

JOHN F. CUNNINGHAM

WALTER E. HADLEY, general superintendent of the Carnegie-Illinois Steel Corp.'s Gary Works, has succeeded WALTER MATHESIUS, new vice-president of the United States Steel Corp. of Delaware, as manager of operations in the Chicago district. Mr. Hadley began his connection with U. S. Steel at the National Tube Co., McKeesport, Pa. He was appointed assistant general superintendent of the Gary Work in 1918. E. E. Moore, general superintendent of the Carnegie-Illinois south works in South Chicago will succeed Mr. Hadley as general supt. of the Gary works.

GEOFFREY R. BENNETT is now general manager of the Toledo Scale Co., and will supervise sales, finance, engineering and manufacturing. His brother, HUBERT D. BENNETT, is president and is directing a large-scale research program.

R. A. MCCARTY has been appointed manager, Small Motor Division, Westinghouse Electric & Manufacturing Co., according to an announcement by vice-president RALPH KELLY. Succeeding R. F. FRENGER, Mr. McCarty will have his headquarters at the company's plant in Lima, Ohio.

Mr. McCarty was named manager of the Generator Division in 1935, which position he held until his recent appointment. F. H. STOHR succeeds Mr. McCarty as manager of the Generator Division with headquarters at East Pittsburgh.

C. F. HOOD, executive vice-president of the American Steel & Wire Co., Cleveland, has been elected president to succeed C. F. BLACKMER, resigned as of January 1. Mr. Hood has been associated with the operations of the company since 1917, being successively foreman, assistant superintendent, superintendent, district manager and vice-president in charge of operation.

HARRY ROCKWELL has been elected president of the Burke Machine Tool Co., Conneaut, Ohio, succeeding MRS. FLOY A. BURKE, who died in November. Mr. Rockwell has been identified with the company for the past 29 years and was serving as vice-president at the time of Mrs. Burke's death. Previously he had been general manager for 18 years.

JOHN F. CUNNINGHAM, supervisor of production for the General Electric Company since 1931, has been appointed assistant to the vice-president in charge of manufacturing, succeeding MYRON F. SIMMONS, who is retiring. The announcement was made by W. R. BURROWS, vice-president in charge of manufacturing.

Mr. Cunningham started his service with General Electric in 1901 and rose to be assistant production manager in 1923, and named assistant supervisor of production in 1928. He was appointed supervisor in 1931.

HARRY A. TRUESDALE, president and general manager of the Conneaut Can Co., Conneaut, Ohio, has retired from the post of general manager, effective Jan. 1, but will continue as president. A. M. SMART, superintendent of the plant for the past six years, has been appointed general manager.

ROBERT L. HAMILTON has been appointed sales manager of the Dumore Co., Racine, Wis., makers of Universal motors and lathe grinders to succeed Leland B. Augustine, transferred to Chicago.

ARTHUR T. MURRAY, president of the United American Bosch Corp., resigned to become executive vice-president of the Moore Drop Forging Co., Springfield, Mass. Mr. Murray will continue with Bosch, however, as director and member of the executive committee.

R. A. McCARTY

F. H. STOHR

ARTHUR T. MURRAY *Backrach*

FRANKLIN H. FOWLER

Armour Plans Course for Executives

Executive control of personnel is the subject of the second annual conference course to be undertaken by the Armour Institute of Technology, Chicago. Twelve dinner meetings at the Palmer House will be addressed by outstanding speakers, and discussion will be featured. Memberships cost $200 for the first firm representatives and others from the same firm can attend for the cost of dinner. Additional information can be obtained from Alexander Schreiber, publicity officer of the Institute. The program follows:

Jan. 17. "Industrial Relations Today." By H. L. McCarthy, regional director, Social Security Board.

Jan. 21. "Practical Training Programs." By John A. Stephens, manager of industrial relations, Carnegie-Illinois Steel Corp.

Jan. 31. "Selection and Advancement." By Johnson O'Connor, Stevens Institute of Technology.

Feb. 7. "The Supervisor and Foreman: Their Problems and Their Training." By Glenn Gardiner, Forstmann Woolen Co., and vice-president of the American Management Association.

Feb. 14. "Social Attitudes a Factor in Industrial Relations." By F. J. Roethlisberger, Graduate School of Business Administration, Harvard University.

Feb. 21. "Practical Problems in Handling Men." By Franklin H. Fowler, president, Foote Bros. Gear & Machine Corp.

Feb. 28. "Setting Objectives and Measuring Performance." By James C. Olson, of Booz, Fry, Allen & Hamilton.

Mar. 7. "Incentives to Performance." By Stanley P. Farwell, president Business Research Corp.

Mar. 14. "Personnel Policies and the Business Cycle." By Raleigh W. Stone, University of Chicago.

Mar. 21. "The Responsibility of the Employer to the Community." By Donald R. Richberg.

Mar. 28. "Industrial Relations in a Unionized Industry." By Morris Greenberg, vice-president and general manager, Hart, Schaffner & Marx.

Apr. 4. "A Philosophy of Industrial Relations." By Harold B. Bergen, McKinsey, Wellington & Co.

BUSINESS ITEMS

Carboloy Co., Inc., Detroit, manufacturers of cemented carbide tools, has added Joseph Highducheck to its organization in the capacity of service engineer. Mr. Highducheck worked with cemented carbides when they were first introduced into this country, when he was assistant superintendent of the manufacturing equipment department, Westinghouse Electric & Mfg. Co. He will be permanently located at the Pittsburgh office but will also cover the Cleveland, Philadelphia and Newark territories.

The Eclipse Counterbore Co., Detroit, has appointed George O. Desautels Co., 334 Postal Station Bldg., Indianapolis, with a branch office at 114 E. Washington St., Muncie, to represent Eclipse products in the state of Indiana (with the exception of the North-West corner of the State) and that portion of Kentucky bordering Indiana.

Marshall & Huschart Machinery Co., Chicago, machine tool dealer, has added E. V. WENZELL to its selling organization.

Tropic-Aire, Inc., manufacturers of hot-water motor vehicle heaters and other accessories, will transfer its operations from Minneapolis to Chicago about the middle of January. The plant will be located at hte southwest corner of Kilbourne Ave. and Augusta Blvd.

Vultee Aircraft Co., is erecting a new factory at 837 Cerritos Ave., Downey District, Los Angeles, to cover an area of 24 x 100 ft.

Fairbanks, Morse & Co., for three decades at 900 South Wabash Ave., Chicago, has moved into the Fairbanks, Morse Bldg., at 600 South Michigan Ave., where it will occupy the first five floors.

Watson-Stillman Co., Roselle, N. J., manufacturers of hydraulic machinery, has transferred its district sales offices from Columbus to Detroit. J. C. GRINDLAY, western sales manager, will be in charge of the new office in the Book Building.

The Triplex Machine Tool Corp., 125 Barclay St., New York, N. Y., is conducting a machine tool demonstration and show at its show rooms from Jan. 10 to Feb. 20. About ten machine tools will be in operation and will be demonstrated.

The Hamilton Tool Co., Hamilton, Ohio, manufacturers of mill-cut rotary files, portable elevating tables, special machinery and tools, has purchased the line of sensitive drilling and tapping machines of the late Adolph Muehlmatt, Cincinnati. This line will be continued under the name Adolph Muehlmatt Division.

The Mall Tool Co., Chicago, Ill., manufacturer of portable flexible-shaft equipment, has purchased the assets, plant and equipment of Wappat, Inc., Pittsburgh. Transactions involving Wappat tools will be conducted by the Mall Tool Co., at Chicago or Pittsburgh.

Jessop Steel Co., Washington, Pa., announces that an arrangement has been concluded with Forgings & Castings Corp., Ferndale, Mich., whereby the Jessop sales force will offer complete service on die construction steels.

The name of the Manley Products, Corp., State & Hay Sts., York, Pa., has been changed to the Remco Products Corp., same address. There has been no change in management, ROBERT E. MANLEY, president, reports. The change was made to secure uniformity in the name of the company and products—valves, motor drives and garage equipment.

National Aircraft Co., is building a plant adjoining the Municipal Airport in Long Beach, Calif., to employ 800 workers. A new airplane designed by DR. W. C. ROCKEFELLER of the California Institute of Technology will be built.

Lockheed Aircraft Corp., Burbank, Calif., will increase floor space by 25,000 sq. ft. including an extension of the hydro-press building for sheet metal work, according to ROBERT E. GROSS, president. Cost of the program will be approximately $41,500.

A new shop and warehouse is being erected at 1207 Thirty-fourth St., Bakersfield, Calif., for the H. C. Smith Oil Tool Co.

The Norton Co., Worcester, Mass., has appointed ROBERT M. ONAN as salesman for the refractories section of the abrasive division. He will make his headquarters in Chicago office, while covering several states.

The Cincinnati office of the Allen-Bradley Co. has been moved from 602 Cincinnati Terminal Warehouse to newer and larger offices at 2331 Reading Road. W. L. JAECKEL is district manager.

OBITUARIES

WILL B. ANDERSON, 56, manager of the textile-machinery branch, Barber-Coleman Co., Framingham, Mass., died Dec. 30 after 30 years with the company.

HOMER P. SNYDER, 74, president of the Homer P. Snyder Mfg. Co., Little Falls, N. Y., manufacturer of bicycles, died December 30. He organized the company 22 years ago.

EDGAR E. ADAMS, vice-president and general manager in 1931 of the Cleveland Hardware Co., now the Cleveland Hardware & Forging Co., died December 21 at the age of 66.

OSCAR E. LINDEMANN, director and chief purchasing agent, A. J. Lindemann & Hoverson Co., Milwaukee, stove manufacturer, died as a result of injuries on Dec. 20. Mr. Lindemann was only 44 and he was the son of ALBERT J. LINDEMANN, co-founder of the company and chairman of the board.

THOMAS J. PRYCE, sales manager of the Wisconsin Screw Co., Racine, Wis., died Dec. 22 at the age of 50.

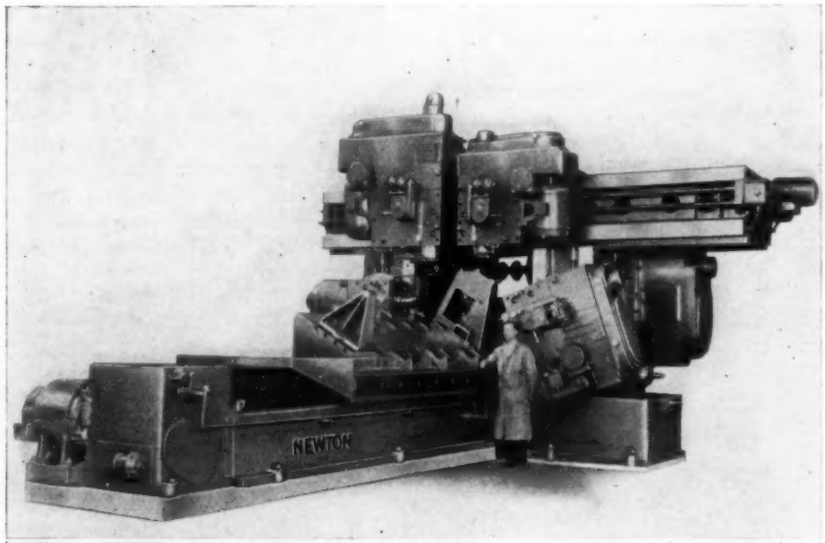
TINE P. DICKINSON, secretary-treasurer and general manager Industrial Machine Tool Co., Indianapolis, died Dec. 22 after an illness of six weeks. He went with International 31 years ago.

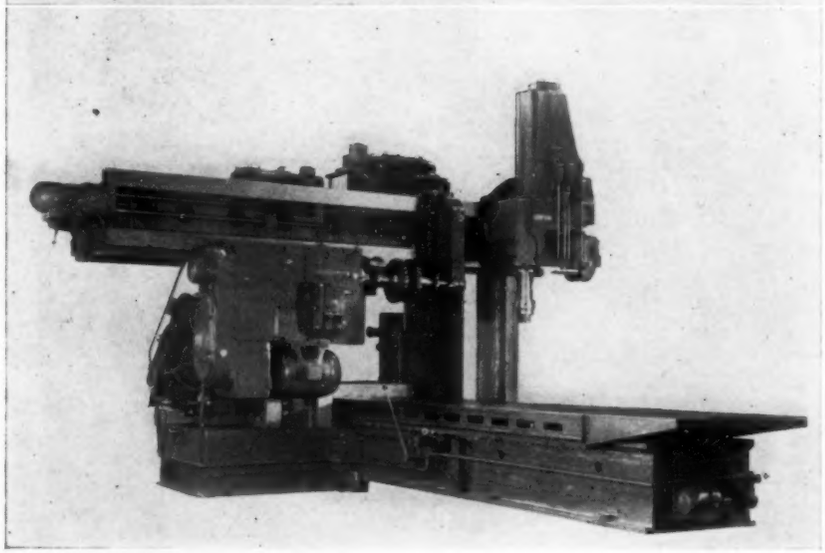
SHOP EQUIPMENT NEWS

(Each description ends with a number. For further data, check this number on the post card, page 40a)

Newton Type L-76 Unit-Head Straight-Line Milling Machine

Designed and built by the Newton Div., Consolidated Machine Tool Corp., Rochester, N. Y., this Type L-76 straight-line milling machine surface mills the crank cases and bores cylinder seats for straight 8, V-12 and V-16 Diesel engines. Simplicity of control, ease of adjustment and convenience of making speed and cutter changes are features claimed for this unit. Basically, the machine consists of five milling heads and one boring head. Two swiveling milling heads are mounted on the front upright, two swiveling heads on the front face of the cross girt and one non-swiveling head on the rear upright. An outboard bearing is provided on the rear cross girt for supporting a horizontal cutter arbor. The swiveling boring head is mounted on the rear face of the cross girt and can be traversed to any position across the table.





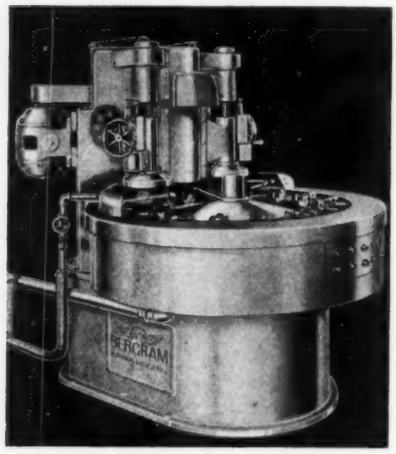
Four unit milling heads are positioned on the uprights and cross girt on the front side of this Type L-76 milling machine, above, while a swiveling boring head and one non-swiveling milling head are mounted on the rear side of these same machine units, below, for milling and boring operations on large Diesel-engine crank cases. Designed and built by Consolidated Machine Tool Corporation, this machine is interlocked so that table cannot be moved when boring bar is in use

Unit milling heads are of standard construction with spindle mounted in Timken bearings. These heads are arranged for individual motor drives through suitable reduction gears, which include flame-hardened herring bone gears for the final drive and a pair of pick-off speed gears which can be transposed or changed for varying the cutting speed. Each head is adjustable on its support and spindle quills have in and out movement for positioning by means of a motor mounted on the head and also by hand. Boring head, like other heads, is mounted in Timken bearings. Rapid traverse of boring bar is by separate motor. Quick feed changes are accomplished by means of a lever convenient to the operator.

Table feed is from an adjustable speed motor connected to the gear box with a clutch for selecting between rapid traverse and feed. Drive is transmitted through a large-diameter coarse-pitch screw operating in a nut bolted to the underside of the table. Table is so interlocked that it cannot be moved when the boring bar is down.

Provision is made for take-up on all spindle bearings and all slides are gibbed for maintaining proper alignment. Micrometer dials are mounted on each head for precision positioning. Cutter coolant is sup-

plied through a motor-operated pump. Table ways and feed gears are lubricated by a motor-driven pump located at the end of the bed. Each head has forced lubrication to gears and bearings. There are eighteen motors mounted on this machine, ranging from ¾ to 30 hp. Table is 17 ft. long and has a travel of 25½ ft. Width of table is 5 ft. Distance from cross rail to table is 5 ft. 3 in., and machines weighs approximately 250,000 lb. **(1)**



Bergram Type SG-1 Surface Grinder

The Type SG-1 production surface grinding machine announced by Bergram Mechanical Engineering Co., New Britain, Conn., has grinding spindles driven by individual motors through variable speed devices. Table also is individually motor-driven through a variable speed device, thus providing selection of proper work and wheel speeds as required by wheel quality and nature of the material being ground. Automatically operated fixtures, of a number and type determined by the nature of the work, are mounted on a revolving table which passes underneath the grinding wheels for stock removal in selected steps to a uniform height. Diamonds for dressing the wheels are adjustably mounted on the table to maintain uniform finished height of the work. Hand, automatic or pushbutton control is provided for operation of wheel feed.

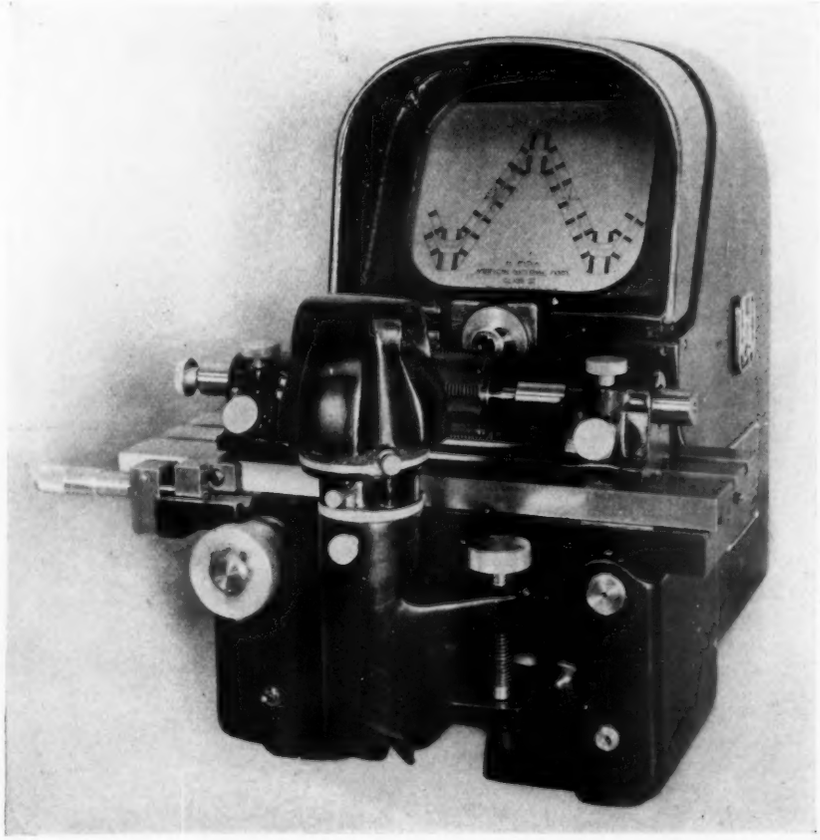
Grinding wheels ranging from 8 to 12 in. in diameter can be used on this machine. Work table is 38 in. in diameter. Machine shown is arranged for wet grinding with work-holding fixtures which close during the grinding portion of one revolution and open for ejecting or loading during the remainder of the revolution, thus eliminating stopping of the work table during the production cycle. These units can be arranged to handle work pieces of any height. To facilitate setting up or changing over from one job to another, a complete assembly of fixtures is permanently mounted on a ring as a unit which is bolted to the table so that it can readily be removed and replaced by another unit. Spindle column and base are of welded steel construction, designed with internal ribbing to provide rigidity and minimum deflection. **(2)**

J. & L. Bench Comparator

A completely redesigned bench model comparator for comparing and measuring by optical projection has been announced by the Jones & Lamson Machine Co., Springfield, Vt. This unit can be furnished with a plain table, suitable for holding staging fixtures to position objects before the projection lens for comparing the magnified shadow against a master outline on the screen. It is also available with a movable table, 16 in. long, for measuring lead or spacing. This table is supported and guided on balls which permit rapid and easy traverse. A suspended weight holds the table anvil against the micrometer anvil attached to the bed. This affords uniform pressure between these measuring points to insure duplication of readings. Lead measurements up to 2 in. at one setting may be accomplished by use of the micrometer and end measuring bars or spacing blocks. The standard micrometer is graduated in 0.0005 in. and a micrometer graduated in 0.0001 in. can be furnished if desired.

Standard centers and center blocks will stage objects 3 in. in diameter by 11 in. long. V-block stages and vise fixtures are standard equipment for staging objects which cannot be held between centers. Focusing of the object on this machine is accomplished by moving the work carrying table to and from the projection system. Lenses are available to give 90X, 50X, 31-¼X, 16X and 10X magnifications.

This comparator is said to be especially adapted to quantity inspection. Only 2 sq. ft. of bench space is required and the table allows ready attachment of staging devices for presenting and positioning small objects so that their magnified contours fall upon the screen in relation to the correct outline. Equipment for inspecting screws and taps consists of a universal staging



fixture in which the work is held for inspection, a master gage with which the work is compared and tolerance charts on which the shadow of the thread is projected for comparison. This fixture with four pairs of rolls will accommodate any screw of a given form from $\frac{1}{8}$ to $1\frac{3}{8}$ in. diameter and any pitch from 6 to 44, whether right or left hand.

Taper taps and hobs may also be measured by using a chart with two tolerance outlines varying in vertical position by the amount of the radial difference of the two portions to be measured. A tooth at the large end having been projected upon the upper true outline, the carriage is then advanced by the micrometer or size block an amount equal to the predetermined length of lead to be measured. The shadow of a tooth spaced equal to the distance the carriage is advanced should fall upon the lower true outline. Any variation from the true outline vertically will indicate error in taper; laterally, lead error. With the center attachment on the comparator, the reading of lead error is as accurate as the thickness of the size block itself. (3)

Farrel-Birmingham 300-Ton Hydraulic Metal Forming Press

Designed for forming, blanking and drawing metal parts, this self-contained, individually-powered, 300-ton hydraulic press, offered by Farrel-Birmingham Co., Inc., Ansonia, Conn., has a motor-driven pump mounted on top. Capacity may be varied between 50 and 300 tons. One 18-in. main ram and two double-acting rams mounted in the top crosshead operate under a maximum working pressure of 2,500 lb. per sq. in. Speed of down-stroke is 241 in. per min. and return traverse is 321 in. per min. Pressing speed is 12.7 in. per min. Maximum opening is 44 in. and maximum stroke is 18 in.

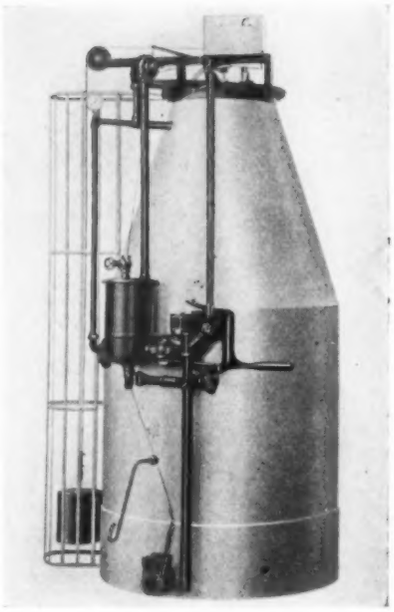
The crossheads and the frames between the top and bottom crossheads are of Meehanite metal and tie rods are of steel. Moving crosshead is equipped with an adjustable knock-out. Adjustment of the moving crosshead guides is made possible by adjustable bronze gibs sliding against the finished interior surfaces of the press side frames.

Control of normal movements of the press is effected by a pedal located at the operator's left. Constant depression of this pedal causes the moving crosshead to approach the work, engage the work at a pre-set pressure and return, to again repeat the cycle. If the operator removes his foot from the pedal, the crosshead movement immediately stops. For die-spotting, a hand-lever is provided. This lever will give slow movement or "inching" of the moving crosshead. (4)

Airco Double-Rated Acetylene Generators

Two double-rated stationary acetylene generators announced by Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y., are available in both 300 and 500 lb. carbide capacities and have rated delivery capacities of 600 and 1,000 cu.ft. of acetylene gas per hour respectively. By employing double-rated generators, plants requiring a large amount of gas for steady production are enabled to meet their demand with a minimum number of units and space. These generators are based on the design of the Airco DB single-rated generators.

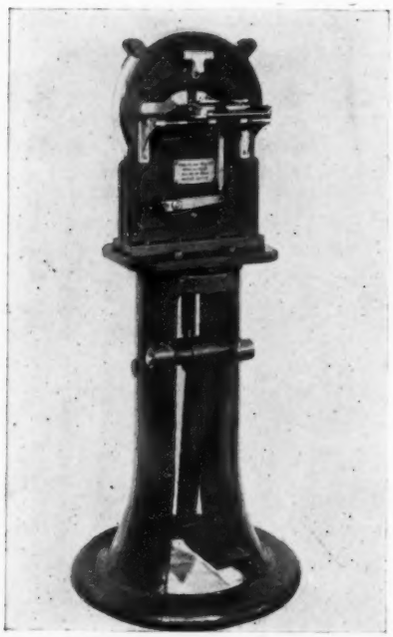
The new units lend themselves to multiple use, due to the small floor space required. The 300 lb. generator shell is $42\frac{3}{4}$ in. in diameter and 105 in. high, while the 500 lb. shell is $54\frac{3}{4}$ in. in diameter and 115 in high. Shells of both units are of heavy gage steel, hot-galvanized inside and out to give maximum protection against corrosion. Over-all height of the generators is $125\frac{1}{2}$ and 137 in. respectively. Pressure regulation of these units is claimed to be so accurate that a reducing valve or regulator is unnecessary. Elimination of the need for a regulator makes it possible to maintain a higher line pressure without exceeding the maximum safe acetylene pressure of 15 lb. per sq.in. in the generator. (5)



Pannier No. 344 Embossing Machine

Designed to emboss from one to six duplicate lettered tags from 0.008 in. thick stock at one time, the Model 344 tag embosser announced by Pannier Bros. Stamp Co., 207-209 Sandusky St., N.S., Pittsburgh, Pa., will stamp tags of various sizes up to a maximum of 3 in. wide by $5\frac{1}{2}$ in. long. Five types of this machine are available, with embossing capacities of from 6 to 9 lines with from 24 to 27 characters to a line. Copy to be embossed on the metal tag is held in a spring clip holder at eye level.

The end of each tooth of the upper embossing wheel is engraved with female embossing characters while the corresponding lower wheel has male characters engraved on a similar tooth, the two forming a complete single character embossing die. These embossing character wheels include the alphabet from A to Z, also &, 1 to 0, comma, period, apostrophe or foot mark, dash, a diagonal line and two blanks. These embossing wheels are meshed with the gear teeth of the outer or control wheel which actuates the revolu-



tion of both embossing wheels simultaneously. Movement of the outer control wheel positions the character desired in the aperture of the character selector.

Depression of the foot treadle raises the male embossing wheel, embossing the character selected, one character at a time, on the metal tag. The same movement of the treadle actuates the trip lever, causing the tag, after embossing the character, to move automatically one space to the left into position for the next character.

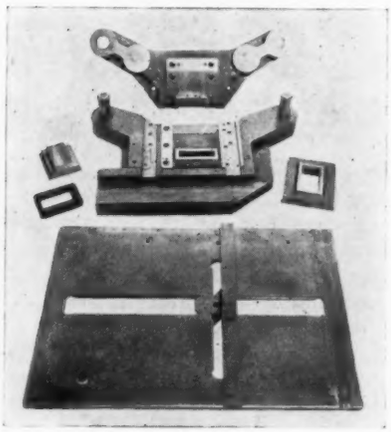
Operator is able to see the surface of the tag as each character is being embossed, thus permitting maximum speed with minimum chance for error. Pedestal type construction requires little floor space, as the machine is 54 in. high, 22½ in. wide and 22½ in. deep. Net weight is 500 lb. **(6)**

"Semco" Utility Center-Notching Die

Intended to provide a quick-set tool for piercing rectangular openings, slots and notches, this center-notching die offered by The Service Machine Co., 752 Broadway, Elizabeth, N. J., is available in two models. Model *A* mounting is intended primarily for notching the sides and ends of metal sheets. Model *B* mounting, shown in the accompanying illustration, provides additional clearance for strips up to 20 in. wide between the guide posts as well as a greater distance from the punch back. Removable guide posts can be provided when desired.

Either a plain adjustable side-gage arm or a full adjustable front gage table can be furnished with the set. Gaging bar of the table can be used parallel with or square with the axis of the set. Ruled scales provide direct-reading of the setting in either direction. A back gage also is provided for use where the ends of long strips are to be notched. Simple rubber-cushion strippers are used where complete holes are to be pierced.

Punches and die plates are readily interchangeable and are self-locat-



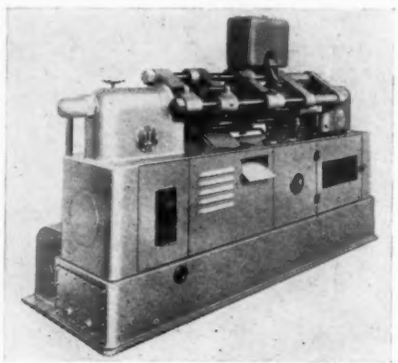
ing. By loosening a clamp both can be removed and replaced without setting up or realignment. Standard sizes are 4¼ in. front to back and either 1½, 2¼ or 3¼ in. width. Any size of punch and die units can be provided within the maximum range of the set, which is 3⅜ by 4¼ in. **(7)**

South Bend 9-In. Bench Lathe

The 1938 model 9-in. "Workshop" bench lathe, offered by South Bend Lathe Works, 426 E. Madison St., South Bend, Ind., has a screw thread cutting range of 2 to 112 threads per inch, including 11½ pipe thread, power longitudinal feeds from 0.002 to 0.015 in. and the 12-speed model equipped with a 2-speed countershaft develops spindle speeds of 40 to 1,200 r.p.m. Other features of this lathe include a twin gear reverse for cutting right and left-hand screw threads, adjustable spindle bearings, adjustable gibs on cross feed and compound rest and a precision lead screw. This lathe is available in various models for bench and pedestal mounting and for motor and belt drive. Four bed lengths are available with distances between centers of 17, 23, 29 and 35 in. Various attachments are offered. **(8)**

H-P-M Model 25 Molding Press

Model 25 injection molding press offered by The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, can be operated either automatically, semi-automatically, or manually. For full-automatic control, the cycle is started with a limit switch which is engaged by the return movement of the clamp ram. Dual starter buttons are provided for semi-automatic operation, requiring the operator to use both hands to put the press into motion, thus providing a safety factor by keeping his hands clear of the die. Manual cycle is controlled by the operator through two conveniently located pilot valves. Press involves a combination of two major hydraulic members, one being the molding clamp member with a horizontal hydraulic cylinder and double-acting ram and moving and floating die platens. The second hydraulic member is the plastic extrusion unit which has a horizontal hydraulic cylinder and a double-acting ram actuating the extrusion plunger.



Functions performed by this machine include: (1) clamping the mold halves, (2) feeding the material in measured quantities, (3) heating the material to plasticity, (4) contacting the plastic material chamber outlet with the mold inlet, (5) extruding the plastic material from the heating chamber under intensi-

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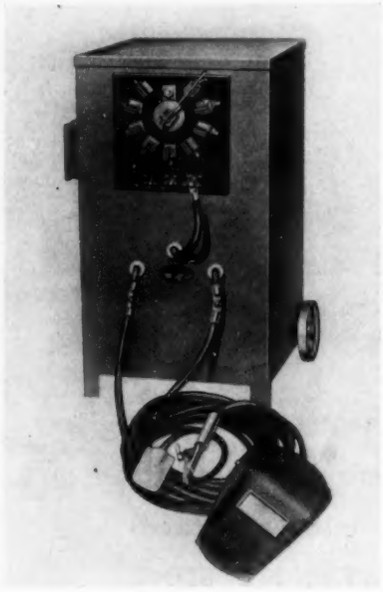
fied hydraulic pressures into the mold cavities where the plastic chills and sets, (6) opening the mold, (7) ejecting the finished article. Thermoplastic material is heated by circulating oil through a channel around the material chamber. This oil is heated electrically and the temperature is controlled accurately by an indicating thermostat.

This press, the first of a series, provides a 10 in. diameter die space and is operated by a H-P-M Model 4R radial pump contained in the unit. This unit will be followed by two other sizes, the Model 80, with a die space of 12x18 in. and the Model 100, with a space of 24x24 in. **(9)**

Giant Grip A. C. Portable Welder

The "Industrial" model portable a.c. welder offered by Giant Grip Mfg. Co., Oshkash, Wis., has a current range from 10 amp. to maximum output, with open circuit arc in 80, 85 and 90 volts; higher voltage can be supplied if desired. Voltage changes are accomplished by changing the leads in the box mounted on the side of the cabinet.



Transformer coils are constructed to permit maximum cooling with elimination of hot spots in the center of the coils. Forced circulation provides ample movement of air. Knife switch control is placed on the front of the cabinet. Four models are available, with maximum capacity ranging from 300 to 600 amp. and weight ranging from 425 to 850 lb. **(10)**

Hammond Model WRO Floorstand Grinder

Listed as the Model WRO overhanging-spindle grinder, this machine, announced by Hammond Machinery Builders, Inc., Kalamazoo, Mich., is said to be especially adaptable for use where large, bulky work must be ground and extra space around the wheel is at a premium. The top section overhangs 12½ in. from the lower front of the base and distance between wheels is 40⅜ in. Grinder is equipped with 14 in. diameter wheel guards and standard equipment includes pushbutton control with an automatic motor starter having thermal overload protection. Motors up to 7½ hp. can be fitted inside the base. Net weight of the machine is 1,200 lb. Work rests can be furnished if required. **(11)**

Spencer ¾-Hp. Vacuum Cleaner

Recommended for industrial use where the amount of dust and litter to be handled is within the capacity of the machine, this ¾ hp. heavy-duty industrial vacuum cleaner, offered by the Spencer Turbine Co., Hartford, Conn., have a large, easily removed dirt can with approximately 2 cu. ft. capacity. A feature of this machine is a single, inverted-bag filter which is cleaned easily without stirring up any dust in the face of the operator.

Machine uses standard hose and tool equipment. A swivel elbow joint and swivel tool connection on the floor handle permits the tool to get into out of the way places. Complete line of wall handles and brushes make overhead cleaning easy with this unit. **(12)**

Carboloy Tap

This tap of solid cemented carbide, developed by Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit, Mich,. is for use on unfired porcelain. It is 0.153 in. in diameter, 1¾ in. long, and has 36 pitch with a full V thread. Experience with these taps has been confined to materials such as Bakelite, unfired porcelain, hard rubber and slate, one tap having been used for 70,000 holes before being reground. **(13)**

C-H Bulletin 9115 Size O Starter

Cutler-Hammer, Inc., 205 N. 12th St., Milwaukee, Wis., offer the size O Bulletin 9115 compact a.c. across-the-line starter, which is rated up to 2 hp., 550 volts. This starter measures 4¾x8 in. It is designed for use with polyphase squirrel-cage motors

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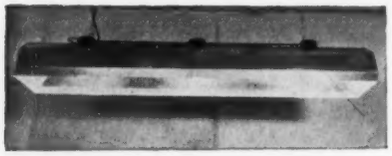
in industrial applications. Among the features of this starter are "push-button" operation, positive quick make and break "twin-break" mechanism, sliver-to-silver contacts, three and four pole construction, thermal overload protection, free tripping, and rubber mounting for the operating mechanism. Mechanism is removable without disturbing the conduit and the interior of the case is finished with aluminum paint to provide maximum visibility. This starter is interchangeable, for all horsepower sizes within its rating, by changing the thermal overload coils. **(14)**



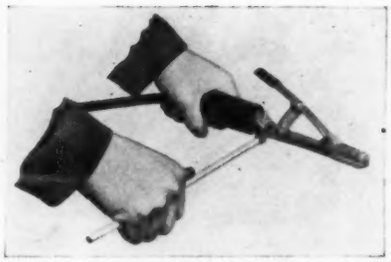
U C C "Ortho-Plane" Lighting Unit

Electronic Control Div., United Cinephone Corp., 43-37 33rd St., Long Island City, N. Y., offers the "Ortho-Plane" lighting unit for direct or indirect use. These units will use all lamps up to 250 watts and are designed to reduce shadows on the lighted surface. Units are available with aluminum finish, but may be finished with baked-enamel in black, gold and gray on special order. Seven planes of light cross each other at different angles. **(15)**

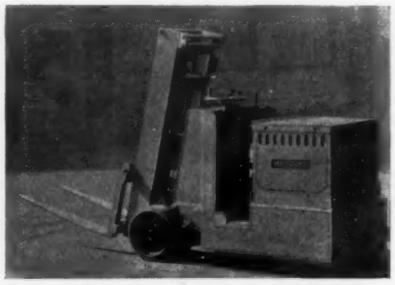
Lincoln Type ST Electrode Holder

Type ST arc-welding electrode holder, announced by The Lincoln Electric Co., Cleveland, Ohio, weighs only 14 oz. and has a continuous current capacity of 250 amp. To assure permanence of connection, all contacts are electrically welded, while connection to the cable is provided by a special, easily-operated clamp which locks the cable to the holder. This clamp can be tightened or loosened without tools by inserting a welding electrode through a hole in the square head of the clamp screw. When tightened, this clamp maintains positive contact with the flat-braided flexible copper strip which carries current to the jaws.

Other features claimed for this holder, in addition to light weight and easy connectibility, are: reduced over-all width, rounded corners to



decrease the likelihood of contacting the holder and causing arcing, use of heavier copper jaws to assure maximum conductivity, grooving of the jaws for vertical and overhead as well as flat welding, hollow fiber handle proportioned to afford a positive grip and a fully insulated thumb lever and non-groundable spring. This holder will accommodate any size electrode up to and including $\frac{1}{4}$-in. diameter. **(16)**



Mercury Type A-1043 Tilting Fork Truck

Available in 50, 54, 60 and 66 in. wheel base sizes, the Type A-1043 tilting telescopic fork truck offered by The Mercury Mfg. Co., Inc., 4118 S. Halsted St., Chicago, Ill., is a front-wheel drive, rear-wheel steer unit of the center control type. The 66-in. wheel-base model has a maximum capacity of 10,000 lb. on 36 in. long forks. Fork elevation is hydraulically operated and the forks travel from a lowered position of $1\frac{3}{4}$ in. above the ground to a height of 107 in. Telescopic fork elevation to a height of 144 in. is available, if required, or the truck can be furnished in the single-lift type with fork elevation to a height of 57 in.

Center-to-center distance of the forks is adjustable, this adjustment being accomplished through the use of a demountable crank which moves the forks through a rack and pinion arrangement. Permanently spaced forks with a rigid load back-rest can be supplied. Drive axle is of the double-reduction spiral bevel and spur gear type, and the steering mechanism is of the Ross cam-and-lever type with steering control by means of a horizontally disposed wheel. This truck will accommodate either battery box compartment or gas-electric unit power source as desired. It has a travel speed of $5\frac{1}{2}$ miles per hr. light and 5 miles per hr. with full load. **(17)**

C-H Window-Type Safety Switch

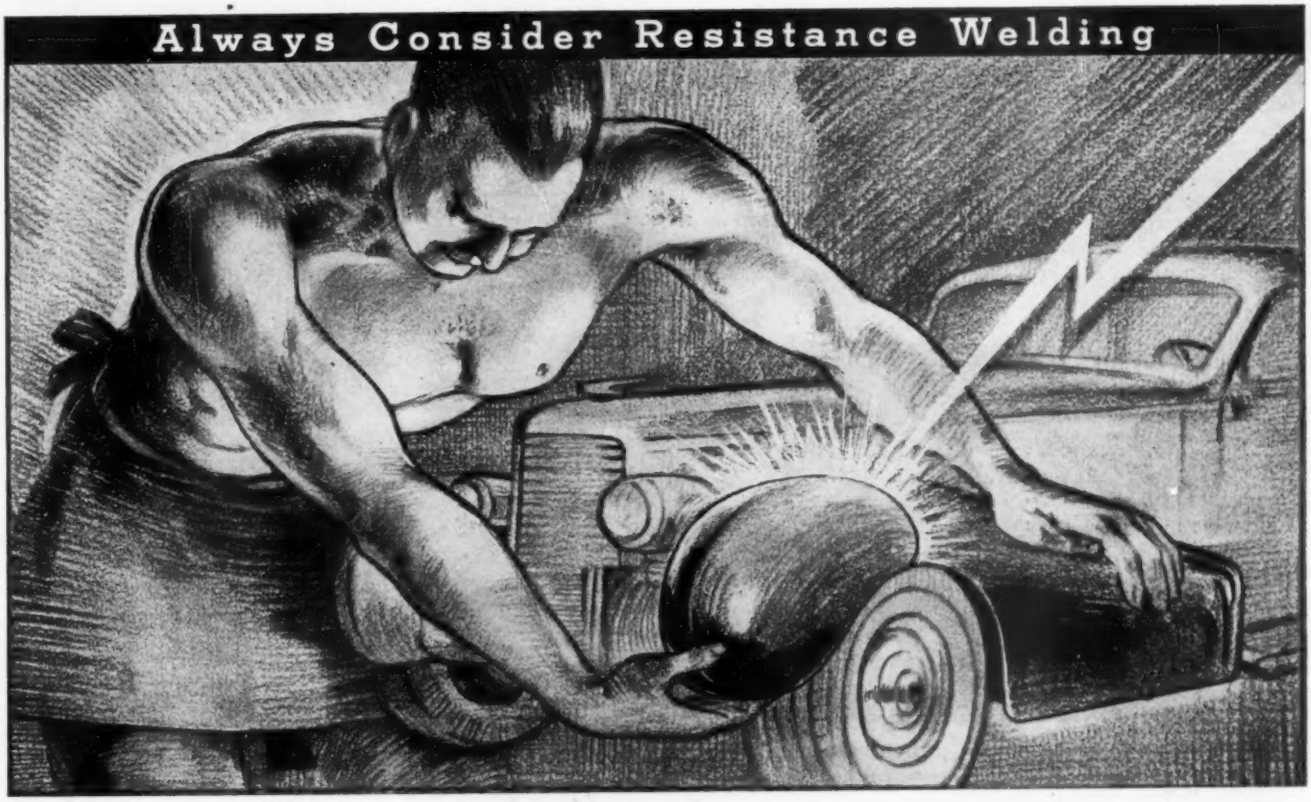
Bulletin 4101 "Current Breaker" mill-duty safety switches, offered by Cutler-Hammer, Inc., 201 N. 12th St., Milwaukee, is., are available with a window in the cover to make inspection of the blades possible from the outside. This window is $\frac{3}{16}$-in. thick shatter-proof glass held securely in place from the inside. A sponge-rubber gasket is used to cushion the glass and seal the opening in the cover.

These switches are available in standard sizes from 30 to 1200 amp. up to 600 volts, fusible and non-fusible. Features of this line are a

quick make and quick break mechanism, pressure-type fuse clamps, non-current carrying hinge posts, double-break air-blanketed contacts, silver-plated blades and jaws, unit pole construction and interlocked cover with key release. **(18)**

Davis Industrial Protective Creams

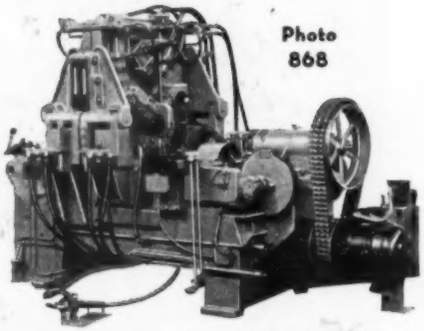
Two creams, one for protecting the hands of industrial workers while at work and the other for use after work, have been announced by The Davis Emergency Equipment Co., 55 Vandam St., New York, N. Y. These products are listed as No. 1



RESISTANCE WELDING • *An Economical Process for Improved Design*

● It is not enough that Resistance Welding has contributed to industry a modern method of metal fabrication to speed up production, lower costs and strengthen assembly. Resistance Welding has given something more —something that increases sales opportunities many times over—and that something is greater possibilities for improved design. With this modern tool of industry at their command, creative engineers have designed products, large and small, with structural beauty heretofore impossible and undreamed of.

Federal Engineers, with 26 years of welding experience, are constantly meeting and solving metal fabrication problems with standard and special machines that set new standards in production possibilities and efficiency. To their application and use may be attributed much of the attractiveness and consequently the saleability of modern motor cars, refrigerators, washers, desks, chairs, motorcycles, hardware, toys and innumerable other items. Resistance Welding is ready to help you in the fabrication of metal parts for improved beauty, greater strength and more efficient, economical production.



● The Federal Fender Welder shown, Photo 868, one of several built for a leading motor car manufacturer, is rated at 200 KVA and with suitable dies, welds front, rear, right and left hand automobile fenders. These welders have mechanical drive through worm gear reduction, Reeves Vari-Speed drive, giving 3 to 1 ratio of speed changes, and 2 H. P. motor. Two upset cams are used on a common shaft to insure accurate push-up and upset. The clamps are hydraulically operated from an oil pump and are articulated to insure accurate electrical contact and uniform pressure all along the sweeping curves of the weld line. About 45 welds per hour are made on each welder, with no scrap.

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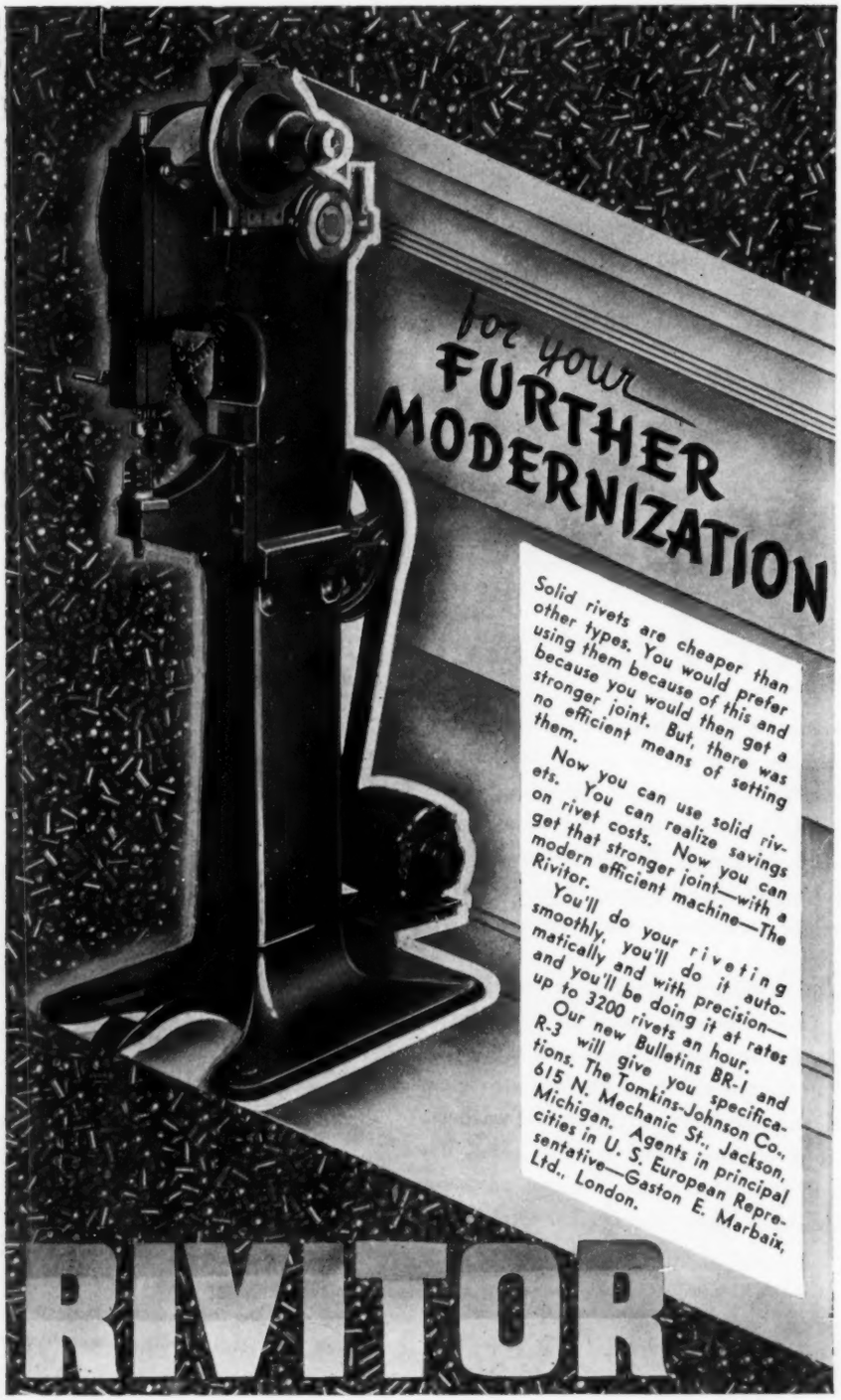
and No. 2 "Eco" protective creams. No. 1 cream is rubbed into the hands, and on the arms if necessary, before starting work. It forms an invisible, non-sticky, unnoticeable film which protects the skin from the action of chemicals, solvents, grease and other substances.

The No. 2 cream is applied after finishing work for the day and is claimed to replace the natural oils of the skin with a soothing cream that keeps the hands soft and free from chapping and cracking. **(19)**

M. & W. Rust-Inhibitor Resistant Lacquer

A clear lacquer that can be used on equipment lubricated with oils containing rush-inhibiting substances is announced by Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J. This lacquer is said not to be discolored or otherwise affected by any of the commonly used inhibitors and also is resistant to humidity, salt spray, 10 per cent hydrochloric acid and other chemicals, as well as out-door exposure. It will stand up well under stamping, forming and other mechanical operations and can be applied to aluminum, brass, copper and other metals by dipping and spraying. It air-dries rapidly. **(20)**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RIVITOR

TRADE PUBLICATIONS

ACCO PRODUCTS Issued by the American Chain & Cable Co., Inc., Bridgeport, Conn., a 8½x3¾ in. reference booklet titled "Acco Products" comprehensively indexes more than 200 different products. A list of sales offices and warehouses is included.

GEAR HOBBERS A mailing folder, announced by The Cleveland Hobbing Machine Co., 1170 East 152nd St., Cleveland, Ohio, illustrates single-spindle, rotary and spiral-bevel "Rigidhobbers" for the manufacture of spline, spur and helical gears.

GRAPHIC INSTRUMENTS A folder now being mailed by The Esterline-Angus Co., Indianapolis, Ind., announces the proposed publication of a comprehensive book dealing with the application and accomplishments of graphic instruments. This book will deal with some 300 actual cases and will have more than 400 illustrations. Publication date is set for Feb. 15, 1938. Regular price will be $3 per copy, and the book is offered at a pre-publication price of $2.50 for all orders received prior to Jan. 15, 1938.

HYDRAULIC PRESSES Hydraulic Press Division, The French Oil Mill Machinery Co., Piqua, Ohio, has announced publication of a 16-page, fully illustrated bulletin showing modern hydraulic equipment.

INSTRUMENTS. Various improvements in recording voltmeters and ammeters are outlined in Bulletin No. 496, announced by the Bristol Co., Waterbury, Conn. Illustrations show sample chart records and features of the operating mechanism.

LIGHT-HOOD A folder offered by Curtis Lighting, Inc., 1123 W. Jackson Blvd., Chicago, Ill., and carrying the title "The Eyes of Industry Are Keener," describes the "Light-Hood" for indirect lighting applications in industrial plants.

LUMINAIRES Indirect-lighting Luminaires are described in an 8-page bulletin, Serial 988, published by Curtis Lighting, Inc., 1123 W. Jackson Blvd., Chicago, Ill.

TANKS Bulletin D-1, offered by Haveg Corp., Newark, Del., discuses rectangular tanks molded from a mixture of acid washed asbestos and a synthetic phenol-formaldehyde resin. These tanks are recommended for pickling and cleaning installations. They are non-conductors of electricity and are not subject to electrolysis, so are suited for electroplating installations. Physical properties are described.

WIRE PRODUCTS An 8-page illustrated booklet describing wire products is offered by Globe Wire Div., Firth-Sterling Steel Co., McKeesport, Pa. This pamphlet contains interesting illustrations and descriptions of wire products ranging from watch-spring wire to tool steel drill rods.

PATENTS

December 21

Metal-Working Machinery

Machine Tool. Lyndon C. Cole, Hamilton, Ohio, assigned to General Machinery Corp., Hamilton, Ohio. Patent 2,102,613.

Machine Tool (Drill). Marion L. Strawn, Rockford, Ill., assigned to The Ingersoll Milling Machine Co., Rockford, Ill. Patent 2,102,655.

Press (Power). Rudolph W. Glasner, Chicago, Ill. Patent 2,102,842.

Machine Tool. Lyndon C. Cole, Hamilton, Ohio, assigned to General Machinery Corp., Hamilton, Ohio. Patent 2,103,147.

Parts and Mechanisms

Wheel Truing Device. Rufus W. Fuller, Deerfield, Mass., assigned to Production Machine Co., Greenfield, Mass. Patent 2,102,841.

Measuring Device, Particularly for Machines for Testing Materials. Alfred J. Amsler, Schaffhouse, Switzerland. Patent 2,102,872.

Processes

Method of Producing Gears. Ernest Wildhaber, Rochester, N. Y., assigned to Gleason Works, Rochester, N. Y. Patent 2,102,659.

Method of Forming Sheet Metal Articles. Ivar A. Morberg, Chicago, Ill., assigned to Western Electric Co., Inc., New York. Patent 2,102,732.

Method of and Apparatus for Making Welding Rods. George T. Southgate, Forest Hills, and James G. Nicolson, Niagara Falls, N. Y. assigned to Union Carbide & Carbon Corp., New York. Patent 2,102,812.

Method of Forming Bolt Heads. Harry Cadwallader, Jr., Philadelphia, Pa. Patent 2,102,941.

Apparatus for Testing Magnetizable Workpieces. Eugen Schweitzer, Wiesbaden-Biebrich, and Sieffried Kiesskalt, Frankfort-on-the-Main-Hochst, Germany, assigned to I. G. Farbenindustrie, Aktiengesellschaft, Frankfort-on-the-Main, Germany. Patent 2,103,224.

Tools and Accessories

Vise. Samuel Thomas Nash, Woden Works, Wednesbury, England, assigned to The Steel Nut & Joseph Hampton Ltd., Wednesbury, England. Patent 2,102,602.

Abrasive Pad. Merwin F. Read, Detroit, Mich. Patent 2,102,745.

Hacksaw (Blade Holder). George J. Blum, Chicago, Ill., assigned to Armstrong-Blum Mfg. Co., Chicago, Ill. Patent 2,102,782.

File. Sol Scheinman, White Plains, N. Y. Patent 2,102,820.

Polishing Wheel. Felix G. Cyrex, Grand Rapids, Mich., assigned to J. C. Miller Co., Grand Rapids, Mich. Patent 2,102,836.

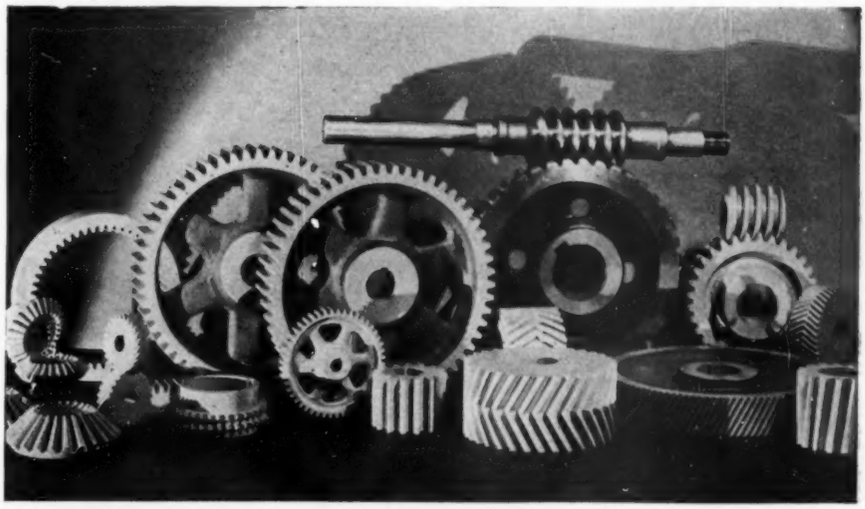
Buffing Wheel and Method of Manufacture. John F. White, Bloomington, Ill. Patent 2,102,867.

Segmental Grinding Wheel. Samuel Rusoff, Longmeadow, Mass. Patent 2,102,919.

NEW BOOKS

HOW TO BE A GOOD FOREMAN. *By Charles Reitell, Stevenson, Jordan & Harrison. 186 pages, 5⅜x8 in. Indexed and illustrated. Clothboard binding. Published by The Ronald Press Company, 15 E. 26th St., New York, N. Y. Price* $1.50.

Fully recognizing the foreman's position as a key man in industrial management, this volume is intended to be a direct aid to those charged with the duties of foremanship. The theory, so popular for a while, of letting the foreman run the men and assigning other duties to experts in their fields has not proved entirely successful. It is now pretty generally recognized that the foreman to be most effective must have a well-



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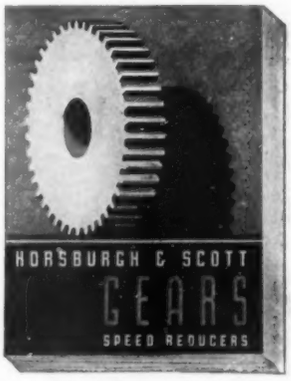

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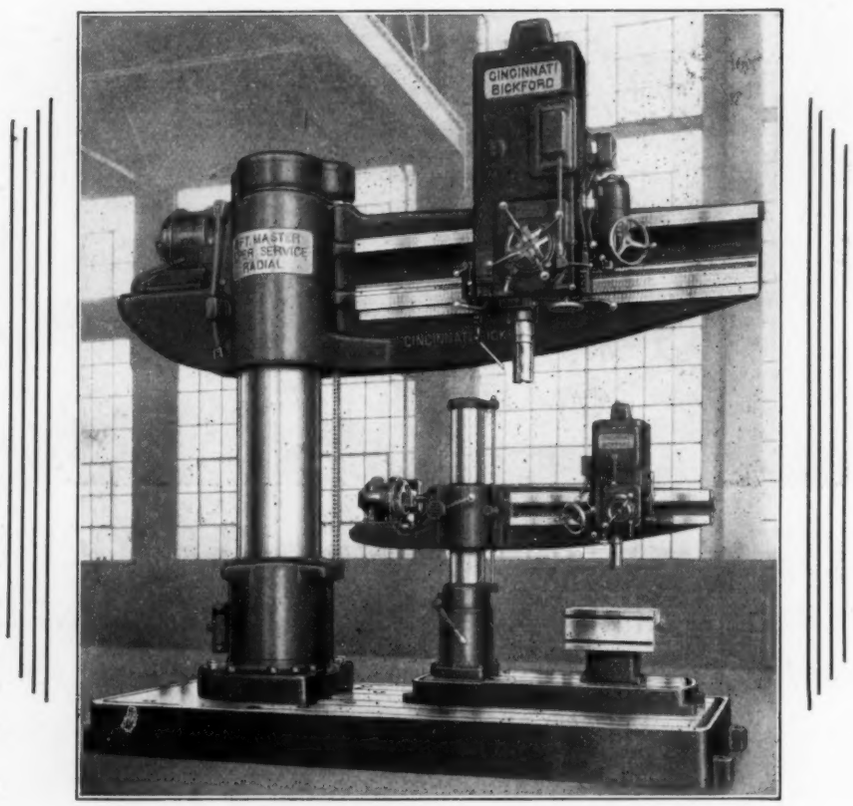
rounded training. In addition to his knowledge of the human elements of his job he must also understand the technical requirements and have at least a working knowledge of the various uses of cost and budgetary control.

This book is based on the many foremen meetings which the author has addressed during the past ten years. And has resulted from the requests received for copies of his talks. It is based on the premise that the foreman as an integral part of management must be regarded as a manager and be given responsibilities and information commensurate with this status.

Rayon Belts

A report comes to us that Germany has found a new material for use in high speed belting. Having abandoned leather in favor of woven silk or cotton belting, manufacturers have now adopted machinery belting which is made of rayon and cellulose.

This idea works two ways. In the first place it reduces imports of foreign raw materials. In the second place users claim that the belting is best for high-speed machinery in that it is slip proof, blow proof and will remain cool after long periods of running.



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OAKLEY CINCINNATI OHIO U.S.A.

60 YEARS AGO

The following appeared in *American Machinist* for January 1878:

MANUFACTURERS

Hill, Clark & Co., Boston, are introducing an original style of hollow spindle turret lathe.

A. F. Prentice & Co., Worcester, are about to bring out a new lathe for brass workers.

Mr. B. F. Sturtevant is moving his blower manufacturing from Boston to Jamaica Plain, five miles out of the city. It will take about a month to get the machinery all set up and in running order.

The Brown & Sharpe Manufacturing Company have just brought out a new automatic gear-cutting machine, the designing and perfection of which has taken a whole year. It cuts gear teeth of any size. The feed-head can be raised so as to cut either straight or bevel gears. It is easily adjusted, and does accurate work with the least possible attention. They have also completed a special machine to cut spur gears (bevel or straight) for the Whitehill Sewing Machine Company, New York.

A new horse-nail company has been organized in Cleveland, says the *Trade Review,* with $50,000 capital to manufacture 1,800 pounds of nails per day. It is called the H. & P. Horse Nail Co.

We often hear it said that there is too much machinery in the country already and that the manufacture should be curtailed until the demand overtakes production. A great part of the machinery now on the market is only fit for the junk shop by reason of its being superseded by improved styles. It is poor economy to buy a machine because it is cheap if it is out of date.

We present this issue of the *American Machinist* in an entirely new dress of type, having removed to our new office, 75 Fulton Street, where we will be glad to see our friends at any time. We congratu-

late our subscribers and advertisers on the remarkable success so far attending our efforts to publish a representative journal of machinery and supplies for machine shops.

An Employer Views the Labor Situation

PHILIP E. BLISS
President, The Warner & Swasey Co.

Management's relationship to its employed force is fundamentally not greatly different, or at least should not be greatly different, from its relationship to its customers. If this conception is accepted, there immediately unfolds a great field of opportunity for the creation of good will arising from better understanding, and for the establishment, if it does not already obtain, of a continuing program of mutual effort, respect, and consideration.

When a management group undertakes to win a prospective customer, it employs the best of its thought, its personality, and every other quality it possesses which it believes will be helpful. Through the printed word, personal visits, perhaps over the radio, it seeks to attract favorable attention to its company and to the product of the service which it has to offer. Every proper means is employed to gain the prospect's attention, to arouse his interest, and to secure his acceptance; but in many cases, in spite of all this effort, some potential customers get away, or are never completely won over.

What is true of a customer is probably equally true of an employee. It is a simple fact of human relationships that a certain number of people regularly shift their allegiance. Some men must be sold over and over again on the soundness of your organization policies and the worth-whileness of your product; they must be constantly wooed by every legitimate device you can employ—and even then you may not succeed in getting their continuing adherence.

It would do most of us little good to have a strong line of loyal customers if we did not have a good line of loyal employees to assist us in serving the customer, and these employees, to be kept strong and loyal, must be treated with the same dignity and respect we show our customers. They must be persuaded that they, too, are getting value received if they make a contract with you; they must in every proper way be convinced that their rights are fully protected, that reasonable opportunity for increased earnings and promotions is provided, and that of all the people who are, or who pretend to be, interested in them, no group or no individual has a greater genuine interest than the management they work with.

Both the employer and the employee have been and will continue to be subjected to a continuous and considerable volume of propaganda of many sorts. The street corner orator, the business association, the labor union, the radio, the newspaper, the casual visiting with one's neighbors or friends, all bring to bear upon both the pressure of a tremendous number and variety of ideas about industrial relations: It goes without saying that a considerable part of all these so-called ideas is of little value, but nevertheless they are presented, and they must be carefully evaluated. There is a question whether a skilled management group is thoroughly competent to make a

9" x 3' South Bend Quick Change Gear Underneath Belt Motor Driven Precision Lathe on a manufacturing operation.

MODERN Industrial machining operations requiring speed, precision and versatility are being handled in hundreds of plants, tool rooms, and machine shops by the new 9-inch South Bend Series "T" Lathes. New features that insure accuracy and maintain it over a period of years, combined with fine workmanship and design, prove these lathes to be a profitable and productive investment.

68 Sizes and Types of Lathes for every purpose.
9" lathe prices start at $85
11" lathe prices start at $371
13" lathe prices start at $448
15" lathe prices start at $544
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Write FOR BULLETIN

Bulletin No. 9-C illustrates, describes and prices the different models of the 9-inch lathe. Copy sent free, upon request.

SOUTH BEND LATHE WORKS
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SOUTH BEND *Precision* LATHES
MODERN LATHES FOR MODERN INDUSTRY

sound appraisal of such material; to expect the average employee, unaided, intelligently to undertake such an analysis and evaluation is probably futile. Perhaps a joint effort would lead to not only a better understanding all around, but to their arriving at far sounder conclusions.

It must be that the employee feels rather overwhelmed by all the efforts made to gain his attention and to influence his thinking and action. He must wonder why all these strangers are suddenly so interested in him, and why they so loudly and persistently assert their right and ability to determine what is good for him, and to see that he gets it. Sooner or later, however, the employee is bound to find himself enmeshed in the web of some school of thought, some set of ideas, some expressed philosophy, or some personality that will gain and hold his thought and allegiance. Such a web is more or less unconsciously woven by the employee himself, after the pattern of the philosophy he has been able to assimilate. It is the wise employer who, realizing this, makes a sincere effort to bring the desires of himself and his employee into conformity, that together they may weave a web around their common interests. Such a web should be strong enough to bear them both through troublesome times; it should be strong enough to enmesh them both because it would be built from a pattern designed with a knowledge of the weakness and strength of both. And there, secure in the web of their own making, protected from destructive and selfish outside influences, they may calmly work for a solution of their common problems.

Abstract of an article in the Service Letter of the National Industrial Conference Board, Nov. 30, 1937.

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Erratum

Our attention has been called by F. H. Ham of Beatty Bros. Limited, whose article appeared in (*AM*—Vol. 81, page 1200), that the address of Beatty Bros. is Fergus, Ontario, instead of Montreal. We are glad to make this correction.

Accident Prevention

W. B. GERO

Assistant Manager of Manufacturing, Lamp Division, Westinghouse Electric & Manufacturing Company

Safety, especially industrial safety, made enormous strides forward as soon as industry gathered it in as part and parcel of its good business activities. When safety was ranked along with production, quality and costs, it gained prestige. The safety movement was assured efficient management and, equally important, a continuity of effort toward preventing accidents.

We have issued a "Safe Practices Manual," which is used as are our specifications covering the manufacturing processes. A copy is furnished each superintendent and department head. Our Safety Organization, as outlined by the bulletin, begins with the general manager who heads a committee which includes the safety engineer. Sub-committees carry the organization right into the rank and file, with a definite chain of responsibility. Periodical meetings are held for constant review of safety matters.

Management is cognizant of the fact that industrial accident prevention is "good business." Economically, it is sound practice to stop the

monetary losses that accompany every accident. The human factor is of as great or even greater importance. Prevention of accidents is everybody's gain and when an accident occurs everybody loses. Efficient practice demands that accident prevention form a definite part of every industrial program. Accidents prevent suffering and waste—and waste increases costs.

Abstracted from talk delivered October 8, 1937, to the Foremen's Safety Club of the Newark Safety Council.

More Power to Welding

The heat for arc welding is provided by an electric arc struck from the welding electrode, a steel rod about $\frac{1}{8}$-in. diameter and 14 in. long, to the parts to be welded together. Each pound of electrodes consumes $2\frac{1}{2}$ kw.-hr., and there were 6,500,000 lb. of electrodes welded in 1936. Although the welding heat in gas welding is supplied by burning gases, oxygen and acetylene, electric power to the extent of 7,000,000 kw.-hr. was used last year in manufacturing these gases. The power used by the large number of resistance welding machines is estimated to be 40,000,000 kw.-hr. Summing up, a grand total of 63,000,000 kw.-hr. of electric power was used by welding in 1936.

From a paper presented before the eighteenth annual meeting of the American Welding Society by A. S. Douglass and L. W. Clark, the Detroit Edison Company.

Teamwork — A Help or a Hindrance?

NAT PETER

"Say, Charlie, how long are you going to be using this lathe; how about letting me in for awhile? I haven't much of a job—a couple of hours at most."

"I can't let you have it now, John, and I'll probably be here a week yet. Why don't you try one of the other lathes?"

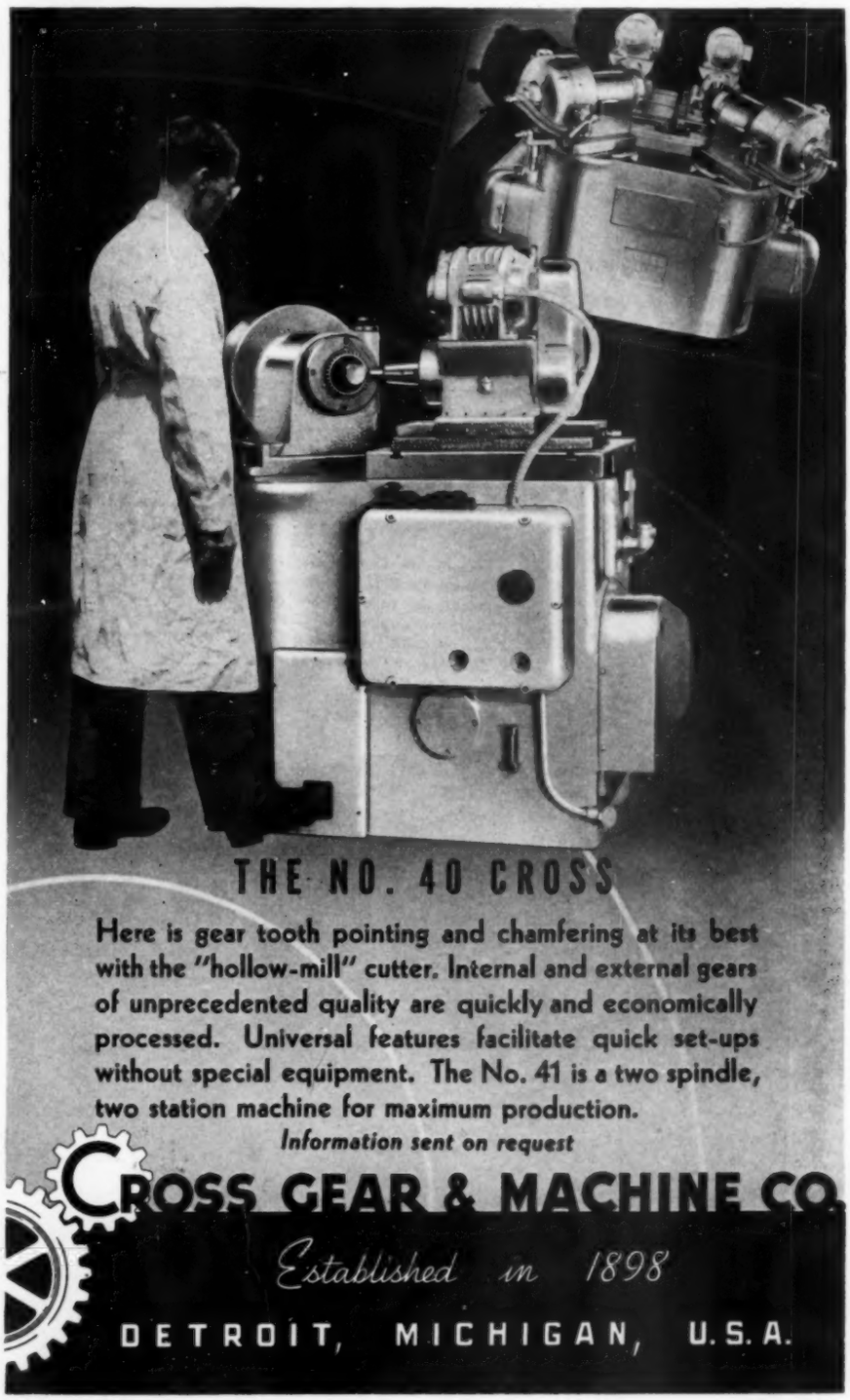
John continues to the next lathe and receives a similar answer, and then to the next, and the next, and the next—all replies are cut from the same negative pattern. There are only six lathes in the shop, which employs about fifteen tool- and diemakers—all on separate jobs. Each man does all the work, from beginning to end, on his particular job.

There is no reason why work in this shop should not progress smoothly and efficiently; but it doesn't—needed teamwork is absent.

John is in a predicament; he needs a lathe. He has already done all the shaper, drill press and bench work on his job. He could use a milling machine for two or three hours, but the millers (there are only three of them) are all being used by other toolmakers.

What is he going to do—stall around and kill time, making a pretense of working, or make a few gadgets for himself while he waits? In either case the company is losing money and, if the toolmaker is working under some system of contract work, he loses too. If he is an average toolmaker, this makes him angry which often is the cause of spoiling intricate work.

John walks over to the milling machines and learns that they will be engaged for hours to come. He has tried only five of the six lathes; the man in the sixth appears very busy. John knows that he has lots of lathe-work to do, as he is turning up parts for a large circular


THE NO. 40 CROSS
Here is gear tooth pointing and chamfering at its best with the "hollow-mill" cutter. Internal and external gears of unprecedented quality are quickly and economically processed. Universal features facilitate quick set-ups without special equipment. The No. 41 is a two spindle, two station machine for maximum production.
Information sent on request
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Established in 1898
DETROIT, MICHIGAN, U.S.A.

drawdie, a rush job. This was the reason he passed him up in the first place. Having now nothing else to do John strolls over and says:

"How about it, Herb, can you let me have this lathe for an hour or two?"

"Certainly, John, in about five minutes I'll have to take this job out of the chuck, then you can do your work. I have some shaper-work to do, and I notice one of the shapers is idle. Besides, there's some drilling and tapping I can do. You go ahead with your work; when you are through give me a call, will you?"

So John walks back to his bench in a happier frame of mind, gets his work ready and brings it over to the lathe. Having a contract on the job, he can now see where he will be able to make a few dollars extra by finishing ahead of the estimated time.

This sketch is typical of conditions found in the small machine shop, average jobbing shop, toolroom and similar establishments, where a limited number of toolmakers, diemakers and machinists are employed. Of course, conditions are different in the larger shops. Here a number of specialists are employed—lathe, shaper, milling-machine, and other machine operators—and the all-around man is usually assigned to the bench, doing the filing, fitting and assembly work.

Teamwork is valuable here, but its lack is not so noticeable nor so disastrous as in the small shop with limited facilities. In the small toolroom, there is little need of the man who specializes in one kind of machine work; everyone must be self-sufficient—capable of operating any machine and of handling a job from start to finish.

Out of those five lather-operators who were so busy they could not let John use their lathe for awhile, at least two (based on a rough average) could have done so with negligible inconvenience to themselves. They were simply reluctant to change before they had finished all the lathe-work they could do; they didn't stop to consider what it meant to the other man. They probably didn't care a hoot whether he would have to wait. Some people never seem to learn to understand that teamwork is an asset to everybody in the shop. If Herb had been like the other five, John would have had to go back to the bench and wait—at a loss to himself and to the company.

All this is needless. The average toolmaker is an intelligent man; he would not be a toolmaker if he were not. Many intelligent and proficient mechanics need to apply their wisdom to their relationships with their co-workers. If a man refuses to co-operate with the men in the shop, they in turn will refuse to accommodate him when he needs it. Friendly cooperation is the solution to many problems, social, economic, financial, both inside and outside the shop.

In the last analysis, when a man works for a living he works for himself. He needs money to buy food and to pay the rent. To get this he exchanges what he has, whether it is goods, skill or knowledge, with the man who is willing to buy.

The toolmaker, in order to co-operate properly with the man who buys his skill and services, must also cooperate with his co-workers. Smooth and effective performance by everybody is conducive to good workmanship and expedites production throughout the shop.

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